ANNUAL PROGRESS AND STATISTICAL NUMBER

ELECTRICAL WORLD

8 - 1934

BUSINESS PROSPECTS FOR 1934

GENERAL BUSINESS: All business budgets based upon an expected up-turn. Purchasing power increased, employment greater, governmental expenditures enormous and another year of wear out and rust out. It is safe to plan for a larger volume of business in 1934.

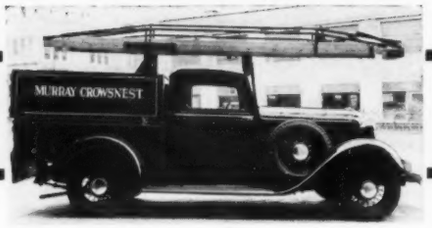
ELECTRICAL MANUFACTURING: An increase of 30 per cent in engineering product sales and of 25 per cent in appliance sales budgeted by electrical manufacturers. Higher prices will prevail. Sales programs expanded. Codes will force changed practices and introduce influence of wholesalers and retailers in distribution.

ELECTRICAL UTILITIES: Capital budget up 25 per cent. Load expected to equal 1931 values. No expectations of greater tax burdens or further competing subsidized plants. Government and municipal plant expenditures for equipment will be large. Conditions more favorable for private utilities. Communication utilities also witness better business, but may face new regulations and forced consolidations.

IN THIS ISSUE: All possible facts and opinions have been compiled and interpreted through the co-operation of men in the industry. This issue is critical and constructive. It supports the prediction that better days and better business lie ahead for the electrical industry.

JANUARY 6, 1934

ONE DOLLAR PER COPY « McGRAW-HILL PUBLISHING COMPANY, INC.

MURRAY  CROWSNEST

LIGHT, STRONG, INEXPENSIVE DEMOUNTABLE

Unexcelled for street light maintenance—adaptable to all standards. Use for tree trimming, traffic light maintenance, line inspection and emergency work.

This new ladder has met with wide approval. It can be easily dismounted if truck is needed for other duties—it is one-man operated—requires but seconds to put in place—may be mounted on any light truck.

METROPOLITAN
DEVICE CORPORATION
1250 ATLANTIC AVENUE
BROOKLYN · NEW YORK
SINCE 1899

METROPOLITAN DEVICE CORPORATION
1250 Atlantic Avenue, Brooklyn, N. Y.

Please send photographs and specifications of the Murray Demountable Crowsnest.

Name .....
Title .....
Company .....
Address .....

Engin.
Wahr

ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

L. W. W. MORROW, Editor

A. M. PERRY, Managing Editor
A. E. KNOWLTON, Associate Editor
E. R. SEARLES, News Editor
G. F. WITTIG, Statistical Editor
EARL WHITEHORNE, Contributing Editor
FRANK R. INNES, Western Editor
C. W. LEIHY, Pacific Coast Editor
H. S. KNOWLTON, Contributing Editor
PAUL WOOTON, Washington Correspondent

JAMES H. RUDD
Publishing Director

Contents Copyrighted, 1934 by McGraw-Hill Publishing Company, Inc.
VOLUME 103—NUMBER 1

ANNUAL PROGRESS AND STATISTICAL NUMBER

JANUARY 6, 1934

Prospects for the Utility Industry 2
By GEORGE B. CORTELYOU

A Program of Self-Preservation 3
By JAMES E. DAVIDSON

Conditions Call for Action 7
By BRITTON I. BUDD

Attack the Attackers 8
By LOUIS B. EGAN

A Time for Conciliation 10
By JOHN J. O'BRIEN

The Outlook for Electrical Manufacturers 11
By J. S. TRITLE

Census Reports—1932 14

Outstanding Facts 16

Utility Revenue and Energy 17

Conditions in Nine Regions 22

Capacity of Utility Stations 24

Capital Expenditures Increase 25

Utility Customers 26

New and Projected Stations 28

The Depression-Proof Industry 29

Conditions in the Southwest 33
By F. M. WILKES

Electrical Manufactures 34

Courage, but What About Confidence? .. 36
By J. B. WHITEHEAD

Engineering Reports 37

Trends in Power Generation 37
Transmission and Distribution 41
Underground Systems. 44
Meters 48
Electrical Developments in Industry 51

Electrical World articles are indexed in Industrial Arts and Engineering Indexes, available in public libraries

ELECTRICAL WORLD—Published weekly, price 25 cents a copy. Subscription rates—United States, Mexico and Central and South American countries $5 a year. Canada, including duty, $7.50 a year. All other countries $9, or 36 shillings, a year. Entered as second-class matter January 20, 1907, at Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W.C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Greenville, S. C.

Printed by The Schweinler Press, N. Y.

McGRAW-HILL PUBLISHING COMPANY, INC.
330 West 42d Street, New York, N. Y.

JAMES H. McGRAW, Chairman of the Board
JAMES H. McGRAW, JR., Vice-Pres. and Treas.
EDGAR KOBAK, Vice-President
HAROLD W. McGRAW, Vice-President
MALCOLM MUIR, President
MASON BRITTON, Vice-President
H. C. PARMELEE, Vice-President
B. R. PUTNAM, Secretary

Cable address: MCGRAWHILL, New York. Member A.B.P. Member A.B.C.

A Lineman Can Splice It

Much of that deferred distribution work can be done now by using

OKOSHEATH

We suggest your getting out the old estimates on those postponed, revamping jobs. They can be greatly reduced by using OKOSHEATH cable. Why? Because this unique cable cuts every detail of expense. It gives you a new way of getting needed things done with a new, low, *over-all* cost.

OKOSHEATH is a simplified, common-sense, non-metallic sheathed cable. It ingeniously combines sheath and insulation in one material. It has no multitudinous layers and wrappings. It's *different!* It is the easiest and cheapest cable to handle, install, splice, and to rack up in manholes. Expert splicers are not needed for OKOSHEATH joints and connections. OKOSHEATH cable is durable either in conduits or in trenches.

Its availability, under prevailing financial conditions, is a fortunate coincidence for the plant operator. Besides lower first cost, it saves in maintenance. The benefits are *both* ways.

Samples, prices and full details will gladly be furnished.

THE OKONITE COMPANY

FOUNDED 1878

THE OKONITE-CALLENDER CABLE COMPANY, INC.
Factories: Passaic, N. J. Paterson, N. J.

SALES OFFICES:

NEW YORK CHICAGO SAN FRANCISCO PHILADELPHIA LOS ANGELES PITTSBURGH SEATTLE BOSTON DALLAS ATLANTA

Novelty Electric Co., Philadelphia, Pa.
The F. D. Lawrence Electric Co., Cincinnati, O.

Canadian Representatives
Engineering Materials, Limited, Montreal

Cuban Representatives
Victor G. Mendoza Co., Havana

OKONITE QUALITY CANNOT BE WRITTEN INTO A SPECIFICATION

ELECTRICAL WORLD

Established 1883—McGraw-Hill Publishing Company, Inc.

for Week Ending

January 6, 1934

L. W. W. MORROW, *Editor*

WANTED . . . A Victorious Attitude

THE electrical industry is now operating with a large proportion of its personnel enslaved by the doctrine of melancholy. And for no good reason. This is just the irrational behavior of human beings under stress. Buffeted by four years of depression, dismayed by the multitudinous acts of the new deal, wracked by a hundred vexatious business, political and human experiences, the men and women of the industry look through dark glasses. They are apathetic, discouraged, afraid, and don't believe in Santa Claus because they don't wish to. They have been unable to "take it." As a consequence their minds are not attuned to deal intelligently and enthusiastically with recovery, reconstruction and reformation. Thus the chief problem of the industry is to shake off this shroud of melancholy so that it may face the future stripped for constructive action. This is a problem in psychology—it must be solved by industry executives.

THERE is nothing wrong with the industry. It has emerged practically uninjured from the depths of the depression. Despite deficits, it is sound financially. Its physical facilities are in good shape. Its products have been improved, new products have been developed and its market possibilities have been expanded. It had improved business in 1933, and prospects for 1934 business are even brighter. The electrical industry supplies products and services essential to national welfare, essential to the bringing about of the social conceptions embodied in the new deal. What is the T.V.A. experiment but a government project to rehabilitate a region by the abundant use of electricity? Facts, markets, social and economic aspirations—all these fix a brighter future for the electrical industry than has been recorded in the post.

WHAT is wanted in the electrical industry is a changed attitude. There must be developed normal human aspirations to build bigger and better things. The future of the industry is a function of human minds only. Its prosperity lies in human actions for self-salvation. How then can the prevailing attitude be changed? One method is to study facts and then make intelligent and logical deductions. Another method is the use of the emotional appeal that comes from intelligent leadership. Both methods should be put to work in the electrical industry.

EACH executive of each electrical enterprise is now marked with a definite responsibility to change his own attitude and that of his employees. He must look at the facts and convince himself that his attitude should be courageous and optimistic. He then, by word of mouth and by written word, must use both the convincing facts and the emotional appeal that goes with leadership to convert his employees. A thousand mass meetings of industry enterprises addressed by their executives frankly, honestly and with the idea of changing doubt to faith would be the most constructive thing that could be done at the present moment. If leaders of the industry fail to measure up to their responsibilities and if employees retain their present attitude the result will be a changed industry personnel. This industry will go forward. The present personnel has the ability and the courage to change inertia into action, depression into prosperity—the present psychological problem can and will be solved.

Prospects for the Utility Industry

By GEORGE B. CORTELYOU
President Edison Electric Institute

THE demand by the public for electric service through the fourth year of a severe economic depression is, in my opinion, an outstanding feature of the electric light and power industry at the present time. That the public highly esteems the use of electricity is very apparent, for in spite of greatly reduced family incomes and the necessity for curtailing expenditures wherever possible, customers generally have continued their use of electricity. This is striking proof that electric service is rated by the consumer to be worth considerably more than he is paying for it. The average domestic customer in 1933 used even more electricity than he did in 1932 and *21* per cent more than in the boom year of 1929.

Other developments of the year were discouraging. The most unfavorable development was the enormous extent of the increase in federal and state taxes imposed.

The tax rate of the electric light and power companies, on the basis of gross revenue, was boosted to the extravagant amount of one-third during the single year 1933. Taxes to be paid to federal, state and local governments in 1934 are estimated at 40 per cent of operating income. Expressed in another way, the total tax bill of the electric light and power companies at the present time is equal to about 46 per cent of the total revenue from their domestic consumers. It is the equivalent of 2.6 cents on every kilowatt-hour sold by the electric light and power companies to their domestic consumers.

Aside from the enormous increase in taxes, the most disturbing development of the year was the launching of the federal government on a broad scale into the direct construction of, or the loaning of money to districts or municipalities for the construction of, generating, transmitting and distributing facilities for supplying electric energy to the public. The latest announcement of the federal government states its intention to effect a broad scale distribution of electric-using appliances to the home and farm. This development has been undertaken at a time when the country is already supplied with cheap and dependable electric service and electric light and power companies have an uncomfortably large percentage of excess capacity which has caused them to seek every possible market for the sale of their product.

Another important development of the year just ended was the increase in payroll expense of electric light and power companies as an outcome of the enactment by Congress of the national industrial recovery act. At the request of the federal government, addressed to private electric light and power companies, payrolls were materially expanded by the adoption of shorter hours of work and higher rates of pay.

During this same period rates for electricity have been substantially reduced. A measure of the extent of this reduction is furnished by the fact that sales of electric current for all classes of service for the year 1933 were 3 per cent greater than the sales for 1932, whereas the total revenue from ultimate consumers was 4 per cent less in 1933 than it was in 1932. Part of this reduction has been automatic through the increased use of electricity, particularly by industry. Rate schedules are so constructed that the greater the use of electricity the lower the average price. But a substantial part of this reduction has come about by reason of lowered rates.

In order to meet the urgent needs of industries which use electricity in their operations, rates to industrial consumers were materially reduced during the year. The average price per kilowatt-hour sold to industry reached during midsummer the lowest point in its history, except for a brief period during the war year of 1917. Rates to the domestic consumer continued their downward trend, dropping from 5.58 cents per kilowatt-hour at the end of 1932 to 5.48 cents at the end of 1933.

The added tax burden alone places a most serious handicap on private enterprise in competition with government-owned enterprises, which escape taxes. At the present time electric light and power companies are selling approximately 95 per cent of the electricity used in the United States, notwithstanding the fact that municipal ownership of electric plants dates back to the same year, 1882, that the first privately owned central station was placed in operation. There have been established at one time or another about 3,900 municipal plants in the United States and, according to the U.S. Bureau of the Census, there are still about 1,800 such plants. The net change in the number of municipal plants reported for the five-year period 1927 to 1932 was a loss of 400 municipal plants.

It is not by chance that this enormous demand for electric service has grown up under private enterprise. The electric light and power companies are conscious of the fact that individually, and collectively through

their trade associations, they have continued through many years of active and well-directed effort to push forward technical developments in the art of rendering electric service and to promote the use of electricity. Their record of rate reductions over a long period of years is sufficient proof of the fact that they have been fair in passing on to their customers the benefits derived from these new developments and from improved operating methods.

Private enterprise in the conduct of business, by comparison with business conducted by governmental agency, has the great advantage of initiative. This advantage goes far toward offsetting many of the unfair advantages which government takes to itself in competing with private business, and over a period of years will surely assert itself, as has so often been demonstrated. So long as each individual company continues to do a better job of rendering electric service than any other organization is capable of doing, it may confidently be expected that electric light and power companies will continue to sell the great bulk of electricity used in the United States.

▼ ▼ ▼

A Program of Self-Salvation

A time for fearless action.
Suggestions for utility development.
Concentrate upon public relations and load building.
Approaches to national and local problems.

By JAMES E. DAVIDSON
President Nebraska Power Company

WE OF the electric industry may not be afraid of the "big bad wolf," but our fearlessness alone does not provide a solution to the many and varied problems that today confront our industry. Not only are we faced with the necessity of creating an immediate, better and more sympathetic public understanding, but we must be mindful also of our responsibilities to our millions of security holders by creating greater kilowatt-hour consumption. And there are millions more who are interested indirectly, through the heavy investments of life insurance companies in the securities of our industry, whose interests must be seriously considered.

The network of unfair regulation, excessive taxation and unfair competition that the railroads have had to fight since 1900 will be only so many threads compared to what our industry faces unless we carry out a broad, straightforward program of self-salvation.

Let's look at the national picture as it is today. After four years of depression we find our country embarked upon many new theories of government and economics. Where these new roads will lead and what effect they will have upon American business, especially in our industry, is hard to foretell. Regardless of our personal views, if the electric industry fails to cope with the trend of the times, it may be caught in the whirlpool and carried to depths from which it might be years in recovering.

This is not the time to meditate upon the rights or wrongs of such agitation. It is the time to take an inventory of ourselves and map out a program that will protect our interests, the interests of our public and the interests of the several million men and women who have placed their savings in our trusteeship.

I am not one of those who think that the country is going to the dogs and that the red flag will supplant Old Glory. However, I am not unmindful of the serious problem that faces our power companies and what can happen if we do not take the necessary steps to protect our interests.

For an industry that has developed within half a century a great public service at constantly decreasing costs, with its ever-increasing obligations of citizenship, we have no reason to bend the knee in humble apology to any class or any group. True, there has been some conduct of our industry regarded as overt acts against the common good. In the great majority of these cases, however, it may be truthfully said that they have been sins of omission rather than of commission. They have been the honest errors of a business period. They have been mistakes created by too great an optimism. However, the many should not be forced to suffer for the errors of the few, especially in light of the tremendous force for social betterment that our industry has stood for in America for a half century.

I have confidence in the fairness of the American people, and if we place our affairs in a show window so that the people can see our companies as they actually are, the public will continue to be fair and friendly. The

electric industry will then not be so crippled that it will be unable to render the service that public good demands.

To a great extent our problems today are local. Every company must so act locally that it will have not only the understanding of its customers and its public, but also their sympathy. Even though our problems are largely local, however, they are also national in scope.

While attacks are being made upon our industry as a national whole, we stand by silently. These unanswered attacks stimulate local attacks and break down confidence. Our industry does not lack leaders, but it is my humble opinion that there should be worked out some forceful plan by which these unfair national attacks can be met.

Just as baseball has its Landis and the moving picture industry its Will Hays, perhaps we should have some type of national spokesman. Then, when attacks upon our industry are made on a national scale, it would be possible to give an immediate and fully informed reply so that the public may know the truth.

The local policy calls for courage in presenting each company's current problems to its public. I liken the building of a company's public relations to that of an individual's character. The attitude of the public toward a company should be the same as the attitude of friends and acquaintances toward an individual.

The Nebraska Power Company has carried out a policy of fearless, frank, honest discussion in connection with municipal ownership and other agitations. A few months ago a municipal ownership fight was brewing in one of the communities that we serve and one of our representatives was advised that it could be stopped by the payment of a certain amount of money. The offer was spurned.

Then followed the distribution of an anonymous handbill urging municipal ownership of an electric plant. Immediately we published a large advertisement in the local paper with the heading: "There Will Be No Payoff." In a dignified but frank and forceful manner we told of the proposed offer. We stated we were not afraid to present the question of municipal ownership to our customers, because we have always furnished good electric service at fair rates. The result was that the municipal ownership agitation died immediately and has not been heard from since.

Agitation in time of stress is not new. The electrical industry is large. Because of the general use of its service, it is considered a public servant. And so it proves a well-marked target for professional and political agitators.

When ruthless charges are made against your company don't sit idly by and take it. In the eyes of your public "silence gives consent." Reply frankly with the facts and figures. An aggressive spirit displayed by the company executive quickly permeates his entire organization.

A few black sheep in our large family have been properly spanked by an indignant and resentful public. It is now up to the rest of the family to show their own records—records of which the public can be proud and appreciative.

A sincere and honest utility man may prove to be a poor public relations builder, for it takes an expert to map out an intensive advertising and public relations program. Where power and light companies do not have forceful and competent advertising departments of their own, they should retain experts whose business it is to mold public opinion.

What to tell and sell

Here are a few things that every company should "tell and sell" its customers; tell them and sell them, not for a day or a month, but every day of every year, through employee contacts, public speeches, newspaper advertisements, news stories, radio and every other practical, fair form of disseminating information:

Tell your customers in a convincing and forceful manner of the value of your company to the communities it serves.

Tell your customers that a large percentage of every dollar you take in for electric service goes back to the city, county, state and federal governments in the form of taxes.

Tell them that this tax money helps to operate schools and pay school teachers, to provide police and fire protection and sanitation, to pave roads, etc.

Tell them and sell them that electric service rates have been steadily decreased; that their electricity bill is not only the smallest item in their home budget, but that they get more for the amount paid than from any other item of service.

Tell them that during the boom days, when all prices of living shot sky-high, electric rates were not increased, but in most instances were decreased.

Tell them that while your company has consistently reduced rates, tax payments have been steadily increased, even though there may have been but little increase in your property investment.

Tell them of your payrolls, how your employees and their families spend and invest money locally for homes, food, clothes, fuel and other necessities and luxuries of life.

Tell them that your company has been a heavy sufferer of the depression, and that even during the NRA price-raising period, while your costs have mounted, your rates have remained unchanged or reduced, even though in most cities increases were justified.

Power and light companies should take advantage of conditions and situations that arise for putting over their story. As an illustration of how we make timely use of a situation, a recent advertisement of our company told how we are now paying the 3 per cent federal tax and that our total tax bill now amounts to more than one million dollars; that 17 cents out of every dollar that the public pays our company is spent by us for taxes. If the public is made aware of this tremendous increase in taxes it will quickly understand that this increase is comparable to a substantial rate reduction. Practically every newspaper in our territory referred to our high tax expenditure per dollar of revenue in news stories or in editorials.

Public becoming tax-conscious

Because of increased governmental expenditures people are becoming more tax-conscious. The time is ripe to call their attention to the unfairness of tax-exempt property. Power companies in several states are co-operating in presenting this pertinent tax information, especially to their rural customers, because the farmer suffers more from the tax-exempt city, town and village property than any other class. The farmer shoulders a goodly portion of taxes, while publicly owned service is generally not available to him and he receives no benefit. The electric industry of Nebraska told this story in a series of advertisements published in Nebraska's leading farm paper. A similar campaign was sponsored in Missouri. The advertisements were forceful and spectacular.

If this tax-exempt information is clearly, concisely and frankly told it will minimize the economic waste caused by properties that are unwarrantedly placed on

the tax-exempt rolls through municipal, state and federal ownership.

The American people during the past five months have again shown their faith in the original fundamentals of American life. In the majority of instances they have turned thumbs down on attempts to put the government in the electric light and power business. It is a good sign that the people are showing their wisdom in expressing themselves that privately owned companies should continue to furnish them electric service at the lowest possible rates commensurate with a high standard of service.

The immediate problem

In discussions that I have had with fellow associates of our industry the question has come up: Which problem is more important to us at the present time—load building or the development of better public relations? Some have emphatically stated that it is load building, that we should concentrate our attention and energies on developing new business—creating a greater appreciation of the use of electricity in the home for all purposes, especially for illumination, and developing new and greater kilowatt-hour consumption on the part of commercial and industrial customers. Others have contended that our energies should be concentrated on creating an immediate and better understanding on the part of our public; on intrenching ourselves in the minds of our customers and on fostering a better public understanding.

I contend that one is closely interwoven with the other. However, unless we do have good public relations and a sympathetic understanding on the part of our public a great deal of the work which we should do in creating greater kilowatt-hour consumption will be useless. Unless our public has confidence in us, unless our public feels that it is being treated fairly, especially from the standpoint of rates, we cannot do a good load-building job. Unless the public feels friendly it is natural that it will spitefully stint on the use of our electric service. In any business selling a commodity or service good will makes for unstinted buying.

Our companies are the custodians or trustees of electric service. It is our obligation to serve the public well and to make it possible for our customers to obtain the maximum amount of service from electric energy. If we fulfill our trusteeship, automatically we will be carrying out our obligation to the millions of men and women who are our business partners through their security ownership.

In the interests of these men and women we are obliged to develop a better understanding of the value of electric service, which in itself creates greater use and with but little, if any, additional plant investment. What I define as real electric home service is the elimination of drudgery, displacing it with comfort, convenience and economy. This can all be brought about by the use of a dozen or more service-giving devices.

Similar opportunities of increasing kilowatt-hour consumption and making electricity of greater use and benefit await our industry in the commercial field also. However, in all commercial plans we should be mindful of the importance of maintaining friendly trade relations with electrical dealers. In carrying on our commercial activities we have two purposes—first, better and more completely to serve our customers; second, to increase kilowatt-hour consumption. In effecting this we should assist and encourage every channel of the electrical trade. As a matter of fact, our allies in the field of merchandising of electrical equipment are really our selling representatives. The more equipment and appliances that they sell the more our trusteeship is fulfilled and the more our load is increased. Therefore, we should take a broad, long-time view of our commercial situation and work harmoniously, yet continue to be aggressive. It is absolutely imperative that the electric companies maintain their leadership in encouraging a greater use of electricity-consuming appliances and equipment and continue their pioneering activities in acquainting their customers with new uses of service.

What properly stimulated co-operative activity will produce has been best demonstrated by the three-year electric refrigeration sales program just closed. During this three-year activity more than 2,700,000 electric refrigerators were sold, bringing the saturation point up to 24 per cent. These sales produced increased revenue of approximately $65,000,000 yearly, and every year, for our power and light companies, with no increased plant investment and little increase in operating expense.

Similar co-operative activities—home lighting, industrial lighting, electric range selling, "Better Light—Better Sight," and many others—have made, and are making, their contributions toward increased kilowatt-hours. It is this greater consumption of electricity that makes possible lower rates, which is our aim always.

This is the era of co-operation. It is my hope that our industry will continue these co-operative, electric-service-giving activities. They are load builders, and they also encourage our kindred selling agencies.

There are more than 500 splendidly organized local electric refrigeration bureaus in this country. Their officers and members have functioned loyally and successfully. I sincerely hope that these local bureaus will be used to carry on some kind of local selling plan that will be completely and colorfully set up.

New factories are not being built, hence this channel of load increase is at least temporarily closed. NRA codes, however, have made it more evident to industry as a whole that it must seek more effective and efficient methods of operation to meet increased costs of production. Many power companies have taken advantage of this situation and are working closely with factories, large and small, in increasing production by electric time-saving and money-saving equipment and by improving efficiency of industrial workers with proper kinds of illumination.

However, there is considerable resistance offered to this kind of load building under present conditions. Therefore, our companies should find the two most practical avenues of load building among domestic and commercial lighting customers.

Lighting has been the primary business of electric utilities since their inception. Yet it has been treated by us like a "Topsy," when it comes to demonstrating to our customers the importance of proper illumination. We have been laggards also in advertising and demonstrating to them the value of proper and sufficient illumination for home comfort, for use in increasing the sales of mercantile concerns and for more efficient production in factories. The unlimited bounds of this field afford opportunities that have never been capitalized.

In many communities the success of the "Better Light

—Better Sight" campaign is a good example of what may be accomplished. Millions of "Mazda" lamps, as well as modern fixtures and reflectors, were sold through dealers and contractors. All that was needed at the outset was some imagination, planning and a pepped-up selling force. Not only has this brought many new dollars into the cash registers of our companies and dealers, but it has also made many customers proud of the results from their new lighting equipment, as well as making friends for the utilities. There are other lighting fields that are still virtually untouched.

Ninety per cent of the lighting of display windows of business firms is inadequate and poorly done and consequently does about a 10 per cent selling job for those merchants. The "sight meter" which was so widely used in the recent "Better Light—Better Sight" activity may be used to splendid advantage. When the illumination engineer, with the aid of the commercial lighting kit, called on the merchant it was easy for him to demonstrate, in practically every instance, that his lighting was inadequate.

"Seeing is believing"—nothing shows up poor store or factory lighting like a quickly installed proper kind and size illumination unit. This demonstration finds the path of least resistance in selling.

Our company, like other companies, has made good sales records by "light on the spot" demonstrations. One salesman co-operating with an electrical contractor sold a 200-watt floodlighting unit to each of 60 wayside inns and filling stations.

I am a strong advocate of employee-selling campaigns. The Philadelphia Electric Company recently demonstrated the value of this selling plan by using the members of its organization to solicit prospects for improved illumination. Bonuses and special compensation were given the employees for their efforts. Many companies have had outstanding success in their employees' campaigns for the selling of "Mazda" lamps and appliances. The results are not only satisfactory but many employees who have latent natural selling ability are discovered and put to work in the commercial fields, with benefit to themselves and to their companies.

Hold close contacts with customers

Modern merchandising calls for closer contact with our customers. Some companies have followed a plan of dividing up their larger cities and towns into districts, with a district salesman in charge. The basic duty of the district salesman is to sell merchandise, acquaint customers with new appliances and, all in all, to create a greater use of electric service. However, while these district salesmen are selling merchandise, they have become important factors in creating friendly relations for the company. Whenever they uncover complaints or unfriendly feeling they promptly, either personally or by having some one from the general office handle the situation, straighten out any erroneous impressions.

The importance of domestic load was well brought out in a survey recently made by C. E. Michel, vice-president in charge of sales for the Union Electric Light & Power Company. Mr. Michel conducted his survey among fifty utilities located from coast to coast and from Canada to the Gulf. His summary read:

> Now, as never before, the utility needs the domestic appliance load.
>
> Without such load future reductions in domestic rates are jeopardized, as once an electric system is in efficient operation, the total day-by-day cost of operating that system is subject to but small and gradual change, excepting that with increased sale of service to customers already on the line the cost of producing the service goes down and, likewise, the price at which it is sold.
>
> Residential customers, taken nationally, are today using but a fraction of the number of appliances they can profitably use.
>
> In driving for this load the non-utility outlet has a very definite place in the picture and utility merchandising plans must encourage their active co-operation in the task ahead.

The homekeepers of America have, and always will have, a natural and deep interest in their kitchens. It so happens that electric service apparatus and devices can do more in the kitchen, in promoting economy and convenience in the culinary department, than in any other part of the home. This is bound to make a splendid acceptance for the all-electric kitchen. Every utility company should co-operate with the manufacturers and others who are doing so much to educate the American homemaker through national magazines and other ways as to how to plan, construct and operate a modern kitchen. This field is in its pioneering stage and has great promise.

The range, water heater, refrigerator, dishwasher, electric mixer, clock and other important devices which are necessary equipment in the all-electric kitchen will bring many new dollars of revenue to the various branches of the electrical industry.

Build up service department

Home service departments of power companies, when they were first instituted, were primarily interested in educating customers as to the value of the electric refrigerator, range and other household appliances. With many companies, these important home service departments are now stepping out of their "swaddling clothes." They are broadening their activities by giving lectures and demonstrations to women of church organizations and other women's clubs in regard to proper and efficient illumination in the home. In carrying on better lighting programs definite appointments may be made when the home economics group meetings are being held, following a short lecture on home lighting. One of the home-lighting demonstrators of our company has been kept busy filling these appointments, making lighting surveys with a home-lighting kit, in an effort to obtain the most efficient home illumination for our customers.

Quite naturally, the installation of air conditioning—on account of its being in a pioneering state, its installation cost and present business conditions—has had slow acceptance. However, it will forge to the front during the next few years, if we do our part. There are new and old business buildings and residences which are potential prospects for this new, profitable business.

The important thing for us to do now is to start an intensive educational campaign aimed toward building up an acceptance for air-conditioning sales when better times arrive. Theaters, restaurants, offices, stores and hotels have already responded to air conditioning as business stimulants, but our big air-conditioning load is yet to come.

In addition to the air-conditioning departments of utilities, local air-conditioning organizations should be formed immediately. In the membership of these organizations should be air-conditioning equipment men, power salesmen, jobbers, manufacturers, architects,

builders and all other logical members. Educational meetings should be held at least biweekly, under the auspices of the local power and light companies. Manufacturers of air-conditioning equipment have able speakers whom they are willing to furnish.

Because of the large expense in completely air conditioning a home many companies are carrying on activity in selling air filters, air blowers and attic wind equipment. These are merely steppingstones for complete air conditioning in the future.

Enthusiastic sales promotion is bound to place commercial cooking equipment in restaurants and food-serving drug stores which are looking for sales schemes to attract customers. This field is limitless in good or bad times. In any event, companies should systematically have salesmen contact these cooking and other customers, using specialty equipment, to keep its use sold and pave the way for more use when we reach economic normalcy.

Too many power and light companies forget their large and small power users after the contract has been signed. In our company we have a rule that our power customers, both large and small, are to be contacted at regular intervals by our competent industrial representatives. They endeavor to make helpful suggestions in the operation of present machinery. If greater use of electric service will produce improved results, they strive, of course, to sell it on the spot. Should any unsatisfactory conditions exist, prompt action is taken to satisfy the customer.

Because of the depression much farm electrical equipment is now standing idle. Under the guise of economy, many farmers have gone back to working methods of the nineties. In some cases they have returned to the old wood stove while an electric range stands idly by. In many instances the electrically operated grinder is gathering dust. These farmers need attention and should be shown that they are practicing false economy.

The tremendous investment which has been placed in farm lines must be kept earning as much as possible. However, I am not in favor of loading the farmer with more electric appliances than he can pay for. Let us encourage him to use and pay for what he now has and keep him a satisfied customer. Later, he will be a potential prospect.

There are other methods of load building that I have not touched upon. Every practical method should be used to create greater revenue per dollar of plant investment. It is highly important also that we give attention to the very important job of creating a better understanding on the part of our public.

These are big tasks that face us. Our problems are many and trying. But if we possess any of the unflinching, courageous spirit of our far-visioned electric pioneers we will take off our coats, clench our fists and fight—not only for our just rights as American business men, but also for new revenues, that we may protect the investments of our millions of security holders.

Upon such action depends the welfare of our security holders, and only in this way can we maintain our self-respect and simultaneously be of greater service to our customers.

▼ ▼ ▼

Conditions Call for Action

By BRITTON I. BUDD
President Public Service Company of Northern Illinois

GENERAL business conditions in Illinois as they affect public utilities are fairly accurately reflected in the published business curves for the nation. During June, July and August the pick-up which followed the initial inflationary measures of Congress and the administration was materially helped by the Chicago World's Fair—"A Century of Progress." A secondary easing of business activity such as has now followed the initial upturn was not unexpected by those who closely study the course of the commodity and money markets, especially in view of the virtual cessation of capital investments consequent on the passage of the securities act. On the other hand, this secondary dip may prove to be of a temporary nature, if the effort to speed up money circulation now being undertaken by the administration through the unfreezing of closed bank deposits, public works expenditures, farm relief measures and the curtailment of unemployment and enhancement of buying power is successful.

Public utility revenues have shown a tendency to improve in the last few months. Offsetting this tendency, however, and offsetting the advantages gained from drastic reductions in operating expenses, wherever such reductions have been possible, have been the new burdens imposed upon the utilities, such as new federal and state taxes, the NRA, the cost of rate investigations on the part of the regulatory commission and, in many cases, new rate reductions. These additional burdens being imposed upon an industry that is not free to increase its selling prices make it imperative that the security holders of utility companies make themselves heard and stand firmly for the protection of their investments.

Attack the Attackers

By LOUIS H. EGAN
President Union Electric Light & Power Company, St. Louis, Mo.

FIVE years ago our industry was swinging along in grand style. The demand for our product was constantly rising and its rate of growth was accelerating. The future of the business carried a strong appeal and the prospect was a rosy one. We are all familiar with what has happened to us in this five-year interval and what our present situation is, but the industry's doctors have not agreed as to what we ought to do about it. I think that this is so largely because of the fact that our descent from popularity to unpopularity came so quickly and was so pronounced that for a time we declined to recognize it, hoping that it was temporary and would soon pass. This has not proved to be the case and today we are faced with the problem of regaining the ground we have lost. This should in no way be discouraging, but rather it calls for thoughtful recognition of where the fault lies and strong, clean-cut remedial policies.

No business with a property and plant account of almost fifteen billion dollars was ever developed in a comparatively few years without serious mistakes on the part of some of those engaged in it, and in this respect it is safe to say that our industry has run true to form. We have been unusually unfortunate in having a combination of attacks directed at us during the present period of stress. Nevertheless, I am heartened by the thought that out of adversity is frequently born a new set of principles that are speedily found to be wholesome and beneficial. There have already been some casualties in the war that is being waged on us and there will likely be more before the campaign is ended, but we should not be deterred by the violence of unjust attacks from telling our story again and again until it will finally pervade the public consciousness. If our cause is right we may then expect that the unjust attacks will cease, and I believe that they will.

The successful repulse of an attack calls first for the marshaling of brain power, followed by a concentration of man power and resources. The brain power in our industry has been functioning at high speed now for some time and one of the difficulties of evolving plans for a strong defense is that the division leaders are not a unit as to what ought to be done. The result has been that in certain locations there has been dissatisfaction with the leadership displayed and a refusal any longer to continue to follow the policy of replying to attacks with carefully drawn, cold statements passed on by lawyers to make sure that there was nothing libelous in them. There has been too much of that sort of thing and here and there over the country have appeared statements that were clean cut and in which proved facts about the industry have been presented in the vernacular of the day so that they would be understandable and interesting to the man in the street. A chorus of approval has followed the appearance of these statements and the chorus has come from men and women in all walks of life. We should doll up our public statements so that they carry a few sparks of interest, a few human touches, some striking phrases, some catchy slogans. The fundamentals of our story should be repeated again and again, but not necessarily always in the same dress. I take it that the wisdom of repetition in advertising no longer permits of argument.

Start with employees

The marshaling of our forces can well be begun through the medium of almost a quarter of a million of employees, their families and their friends. They must be made acquainted with our story and encouraged to spread it. We have millions of satisfied customers and of trusting investors. From them we may expect a certain amount of support, but I warn against acceptance of the idea that any one else will fight our battle for us, and I see no occasion either to ask them to or expect them to do so. Troubles in this country are not confined to the electric industry today, and while we may think that we have more than our share, I am not so sure of it. We have plenty of them and they should spur us on to extraordinary efforts to correct them. Thoughtful executives will develop many contacts and channels through which our story may be spread and understood. We may expect a certain amount of political antagonism, but that does not alter my belief that there are many officials, local, state, and national, holding erroneous ideas about our business who would change their minds if they knew the facts. This calls for the establishment of closer human relationship than has heretofore been the case. We haven't so many power houses and substations to build now and we might well utilize some of the time we formerly spent in planning and building our physical structure in planning and building a few more intimate human relationships.

Are there any brains in the utility industry? There are plenty of people in the utility business, as well as outside of it, who would reply "Not many" to that question. But in spite of that opinion we electric utility men are not all dumb. One way for us to demonstrate our intelligence is to recognize that hostility to the electric companies to whatever extent it now represents actual public feeling has always been and is now being

manufactured by interested parties for their own profit. Newspapers and magazines must have circulation. That is what they sell to their advertisers. The easiest and most effective way for such publications to increase and hold circulation is always and forever to make charges against persons, companies and institutions. Ostensibly these charges are made by such publications in their self-appointed capacity as guardians of the public virtue and protectors of the public interest. Actually, they are made to build circulation, to supply the commodity that the publication sells to its advertisers.

What is the first and very often the only concern of the politician? To be re-elected. To be re-elected the politician needs votes, and the greatest device for the getting of votes is to inflame the public mind, to trade on prejudices and to manufacture issues. Also, the politician has discovered that by directing public attention to what he calls the iniquity of another he can divert public attention from his own sins and deficiencies.

The electric utilities plead before the bar of public opinion. The radical newspapers and politicians accuse before the bar of public opinion. The bar of public opinion is different from a court of law in that instead of the accused being assumed innocent until he is proved guilty he is assumed guilty until, against great difficulty, he can prove himself innocent. This is usually impossible, and the radical publications and politicians know it very well, so they hasten always to bring their charges and their accusations, knowing that it is not necessary to prove them. I would not go so far as to say that it would be advisable for the electric utilities to attack their attackers with baseless charges, but there are plenty of charges well founded in fact that can be used.

We use the attack

We in this territory carried the fight home to the politicians by revealing a few things to the voters that elect them. As a class school teachers are rather influential in the formation of voting opinion. In recent years they have come to be somewhat radical in their thinking, and they cannot greatly be blamed for this considering what has happened to them in many parts of the United States. There has not been a great deal of default in teachers' salaries in Missouri, but it is quite natural that the Missouri teachers should be sympathetic to the sufferings of their fellows. The Missouri school teachers were considerably shocked and startled to learn that their salaries had been safe so far very largely because the utilities have continued to pay their taxes. Out of the total of more than four million dollars in taxes paid by the Union Electric Light & Power Company and its subsidiaries each year more than $700,000 goes to the schools of the state. Other figures give the school teacher pause when he is told at the same time that municipally owned electric plants do not contribute one cent to educational costs.

In these days of agricultural distress an infallible way to get the farmer into a towering rage is to talk to him about taxes. We talk to him about taxes and the politician feels the effect of his towering rage. The farmer is surprised to learn that municipal utilities pay no taxes and he is justifiably indignant when he discovers that the spread of municipal ownership will take many millions of privately owned utility property from the tax rolls and thereby increase his own tax burden. Municipally owned electric plants are tax exempt, but the co-operative enterprises which the farmer runs—his creameries, his elevators, dairies, refrigerating plants, etc., are fully taxed. This is an outright and unfair discrimination against the farmer. When these facts are brought to his attention the farmer promptly makes his displeasure known to the politician and the politician takes heed.

> Doughty Admiral Farragut said that the best defense is a strong offense. There is a growing sentiment among utility men that their industry has been taking it on the chin plenty long enough and that the policy of meeting attacks only with brave smiles and with hopes for the best is just about worn out. Mr. Egan represents that sentiment and he represents it well. He says that the light and power industry should marshal its resources of brains, men and money and act vigorously on Farragut's advice. Carry the war into the enemy's country, exhorts Mr. Egan, and he tells how his company is doing exactly that.

Low rates for good business

Now as for our resources of money. These money resources are the capital investments of our generating plants, substations, transmission lines, distribution systems and all of the physical facilities that are needed for the supply of electric service. It is these very things that are being attacked and which we must defend. If they are not defended successfully they will be lost. Then it is not only proper but imperative that they should be used in their own defense. The best way to use them is by attacking the enemy with them on his own ground. I mean by this exactly the course we have taken in St. Louis. Our rates have always been among the lowest in the country. Now they are not just among, but are, actually, the lowest. When a residence customer can get down to a 2½-cent rate after the first 32 kw.-hr., for which he pay 5 cents, and finds himself paying only 1½ cents for all use over 200 kw.-hr., then he realizes he is getting cheap electricity. These rates represent a revenue decrease of $1,600,000 per year on the basis of present energy consumption. Certainly the company will feel this loss. Certainly the earnings of the company are impaired by it. But we expect confidently that the loss will soon turn itself into a profit and that earnings will be improved.

We are committed to low rates in St. Louis for the double reason that they destroy the propagandist's favorite argument and because they are decidedly good business. Over the entire system of the Union Electric Light & Power Company and its subsidiaries the average residential consumption for the year ended November 30 was 736 kw.-hr. In the suburban territory just outside of St. Louis the average is 900 kw.-hr. In comparison with the national average these figures are high. They justify our past policy of low rates and we are confident that much higher averages will justify the latest reduction. The new rates are yet too new to give us any figures on their effect, but already we can see the effect, with the rate in operation hardly more than

a month, in the voluntary comments of our customers.

The principal use of electricity to which we look in St. Louis to raise low rate energy consumption to a profitable level is air conditioning. Throughout his whole history man has been manufacturing weather for his comfort. Up until the present time he was able to protect himself against only the discomfort of cold. Now he can find relief from heat by artificial means. I think that air conditioning is the greatest present possibility for future large use of electric service. I think, also, that the electric utilities cannot afford to wait for air conditioning to become an important load through the ordinary course of commercial development. The electric companies should put strong pressure on that development. They should spend their money to hurry it along. We have done that in St. Louis and we are going to continue to do it.

There is reason to believe that the country is now pulling itself out of depression, slowly, laboriously and with frequent pauses of discouragement, but nevertheless continuing on the up-grade. I think that 1934 will be better than 1933 for the electric utilities, not only because of an improvement in general business condition but because a by-product of that improvement must inevitably be a lightening of political pressure on them. As people become more comfortable and prosperous they become less inclined to take notice of the rabid frothings at the mouth of radical newspapers anxious to build circulation and of the tirades of politicians seeking votes. In order to get the most profit from the betterment of general conditions the power companies must make the greatest and the most aggressive possible uses of their resources. They must use their men. They must use their brains. They must use their money.

▼ ▼ ▼

A Time for Conciliation

By JOHN J. O'BRIEN

President Standard Gas & Electric Company, Chicago.

THE utilities have co-operated loyally in the national recovery program, and it is time that a spirit of true conciliation should govern all legislation and negotiations looking toward the settlement of common problems. During the period of extreme national stress through which we are passing it is very difficult to analyze the confused elements and form definite conclusions. In the heroic efforts to restore prosperity, led by President Roosevelt, it is to be expected that the utilities must carry their share of the burden. They are merely a part of the national economic structure and their fortunes inescapably rise or fall with the general welfare.

Unfortunately, the physical and financial soundness of the great bulk of the utilities have made them conspicuous at a time when all possibilities have been ransacked to discover sources for additional taxes. Even though they have suffered heavy losses in business and earnings, their relative stability has encouraged unreasoning demands for rate reductions. In many instances the strain of the depression, and some of the events growing out of it, have caused attacks on these institutions which public opinion in a calmer period would not sustain.

As the result of heavy losses in business, the imposition of additional taxes, increased operating expenses and rate reductions, as well as unusual credit extensions to municipalities and individual customers, the utilities have in numbers of cases been compelled to reduce and pass dividends, and some are confronted with problems in providing for maturing obligations.

I am in full sympathy with President Roosevelt's desire to have utility rates brought down to the lowest basis consistent with good service and stable, efficient administration. This has been our own policy for many years. In order for any utility—either publicly or privately owned—to maintain itself, lower domestic rate levels can be secured only by a far larger individual use of the services provided than is common at present. This fundamental is freely recognized by those in charge of the government experiments. A commercially owned but governmentally regulated company is limited in many ways compared with a government enterprise backed by the United States Treasury and authority to work out untried plans and methods. Yet I am confident that we can achieve as good or better results to the public, all things considered.

The commercial utilities of the United States have pioneered the field of domestic and industrial usage of electricity. Their initiative has brought the benefits of electricity to a larger proportion of homes than in any other country.

It is apparent that utility investors—both individuals and institutions such as life insurance companies, banks, schools, churches, hospitals, etc.—are greatly worried concerning the federal government's incursion into the power business, as well as the present policy to use government funds to finance competing municipally owned plants. Grants and loans of the latter character, however, have not yet reached large proportions, and it is to be hoped that the federal, state and municipal governments will not expand a policy so obviously destructive.

As to the outlook, there is encouragement in a moderate increase in gross earnings during the latter part of 1933 as the result of a definite improvement in general industrial and business activities, which I believe will be accelerated during the coming year. Customers have been coming back on the lines and mains, and the sale of household appliances is considerably better than a year ago. It is probable that the new year will see new business campaigns, much more comprehensive and vigorous than anything of the kind undertaken in the past.

The Outlook for Electrical Manufacturers

By J. S. TRITLE
President National Electrical Manufacturers Association
Vice-President Westinghouse Electric & Manufacturing Company

THE year 1933 will stand out as a landmark in the history of this country. It marked the depths of a most serious business depression and it inaugurated a new era in the relation of government to business and in the co-operation of business enterprises. It brought to a head a political effort to change conditions in order to improve our social and economic order through a more intimate and a closer knit relationship of government, capital and labor—partially voluntary and partially coercive.

Under these striking conditions it is inevitable that the activities and policies of electrical manufacturers have been affected. There have been many changes; there have been many problems; there have been been many opportunities to work individually, collectively and in co-operation with the government. And, looking back over the year, it may be said that electrical manufacturers have done their part. They have not been negative, they have not been inert. On the contrary, they have assumed a position of aggressive leadership and have entered into the new programs with the firm purpose of trying out the new ideas and improving both their internal conditions and their external relationships. They have not yet obtained the answer to many problems and they have not yet visualized the ultimate developments, but they have had and still have faith in the future and they have gone along the new road with courage. This has been done with intelligent watchfulness, with calm yet progressive thinking and with the assistance of constructive action by all individuals, by all groups and. by the officers of N.E.M.A. Splendid beginnings have been recorded.

After surveying the situation at this time we certainly can be optimistic about the future. We know that the codes, the uncertainty of monetary policies, the difficulty of securing capital for ourselves and our customers under the national securities act and the disruption of heretofore pleasant relations of employers and employees are creating grave problems that will call for the united action of all of us for their solution. We know there is much to be done before we can say that the new ideas have been reduced to practical application or have brought material benefits. But enough has been accomplished to establish a broad foundation on which to build our industry. One that will enable us to give better and less wasteful service to the public; one which will permit us to operate in the markets as individuals and as a group on a profitable basis; one which will enable us to collect and study data of the needs of the markets and thus lead to a better co-ordination of production and consumption with a consequent increase in the stability of business and of employment.

We are still in the stage of principles and of initial developments and the coming year is critical in that it will be concerned with the administration of new ideas by new governmental and business organizations. The national recovery act leads us to think that Congress meant to allow industry to unite for two years and to enjoy exemption from anti-trust laws provided it lived up to certain conditions. The initiation was to come from industry, the administration was to be by industry and the intent of the act was permissive and not coercive. Our industry is now organized to carry out this idea of Congress.

At first it seemed that the act had been interpreted by the administration as a coercive law on the theory that recovery should be promoted by advancing wages faster than production or sales, possibly failing to realize that the main lack of purchasing power was not only due to wage rates but to the low price of farm products and the lack of industrial activity. Because of these conditions, purchasing power has not been increased in the same ratio. But a full realization of these facts now seems to exist in administrative circles and they are trying to raise the price of farm products and to stimulate industrial activity, particularly in capital goods, which in normal times employ 10,000,000 people and represent an annual business of $30,000,000,000. The stimulation is being given by public works expenditures and by endeavors to place money or credit at the disposal of private industry, either directly or indirectly. These activities are certain to give a greater volume of business to electrical manufacturers of engineering equipment in the near future.

But along with the theory of recovery put into effect by the administration there is a vision or an ideal of a new industrial order that would come out of the adop-

tion of the industry codes. This vision dealt with trade practices, with the relations of labor and capital and with the regulation of industry in the public interest. Perhaps the administration has tried to realize its vision too rapidly; perhaps it has tried too zealously to impose its ideas upon industry instead of encouraging a gradual and controlled growth in industry; perhaps there has been a tendency toward an excessive centralization and the excercise of a too dictatorial spirit by the government. This would be a natural reaction to the revolutionary conceptions introduced last March by enthusiastic advocates. But these errors are not fundamental, they will be adjusted and corrected.

We must keep in mind the larger conception and not be led astray by details or by small difficulties. We must be courageous and drop the fashion of the past wherein reliance was placed upon time for the correction of maladjustments by supposedly automatic processes and exercise our intelligence in administering an action program such as the NRA represents to produce results more quickly and more effectively. This is the brave policy upon which the country is embarked and, even though somewhat experimental and untried, the NRA program is the plan that has been accepted for use. Viewed in this perspective, the developments to date are encouraging. Millions of people have been put back to work and the increased rates now being paid have put hundreds of millions of dollars into circulation.

Practical aspects of codes

We have now reached the stage wherein the codes are adopted and must be administered. We must turn our attention from theory, principles and approved platforms to business administration and to commercial practice. And industry must do this work and not the government, for the very principles of NRA will fail utterly if they lead to government bureaucracy instead of to industrial self-government. Each industry must carry out the practical features of NRA in a spirit of public service by means of the unselfish co-operation of all employers and employees. Individual and collective initiative must be encouraged and not discouraged. Hope for the future must be held out especially for the coming generation.

Electrical manufacturers have gone far along this road. They have had an approved code for several months. They have come together and discussed code operations and, through N.E.M.A., have come to know each other better and thus to realize the mutuality of interests that exists in the electrical business. After careful study electrical manufactured products have been classified into some seventeen groups and code authorities have been placed at the head of each group. These code supervisors are all-powerful in carrying out the code under the general supervision of the N.E.M.A. board of governors and the government. They are business men with a direct interest in their code decisions. They are doing their best to carry on in the spirit of the NRA.

Naturally, it takes time to get individual manufacturers acquainted with all the details of code operations; it takes time to institute the business and statistical staffs and methods needed to operate under the code; it takes time to devise plans for taking care of expenses on an equitable basis; it takes time to reconcile conflicting details in codes of manufacturers, wholesalers and retailers and to put production and distribution upon a code basis for all products. But, considering the magnitude of the task; and the new and radical steps involved, the electrical manufacturers have actually made great progress.

They are convinced that their code can be made to operate to the benefit of their industry and of the public. It is already apparent that bad trade practices have been or can be eliminated; that complete statistics can be had and can be used to advantage and that uniform cost accounting can be instituted with a very beneficial effect. There is every reason to think that the N.E.M.A. code will be in full operation under industry self-government in the very near future. Our code will probably be supplemented and developed as needed, and there should be nothing allowed to appear on the horizon to create any doubt that the electrical manufacturers can build on the foundations established by the code to the mutual benefit of all concerned.

Owing to industry's practice of withholding orders until their needs become urgent, and the code's limitation of hours whereby employees are permitted to work only 36 hours per week, it will be necessary for the manufacturer to employ extra shifts with partly trained workers and the necessary additional supervision. Therefore, it presents the problem of using untrained workers at considerable extra cost, the upsetting of existing schedules and the resultant loss of having to dispose of the additional people brought in for these "peaks." Some of these peak conditions could, no doubt, be smoothed out if it were possible for industry to start building seasonal products earlier; that is, during slack periods.

It is exceedingly desirable, if it can be made possible, to employ idle plant facilities by industry anticipating requirements, say, a year ahead, instead of waiting until requirements become almost an emergency; it would not only increase the productive work for absorbing charges in the case mentioned, but would put idle people to work and would permit an orderly manufacture at a resulting lower cost.

Customers can aid production

One of the most disconcerting of our internal problems would be solved if it were possible to institute a source that will ascertain the actual requirements of the customer to the extent of knowing when he will be ready to install equipment. This would avoid the unnecessary expenditure in rushing manufacture and transportation and the additional expense of storage and handling.

There is need for a sound and practical costing procedure for all industries instead of the wide diversity of schemes that are now in vogue and which are so complex that no two interpretations are the same. After the policy of price fixing for producer has ended, customer price protection will be next in order, so that the question will then be not: "How much can we get for a product?" but, "At how *low* can it be sold and still make a profit?"

Again the wide diversity of costing schemes enters into the item mentioned above—that of rehabilitation in industry. Some concerns will attempt to write off a charge in ten years, whereas another will figure on thirty years, making the whole procedure out of balance and a problem for arriving at competitive prices. A fair costing procedure will eliminate this discrepancy.

A false activity is brought about by price increase in that industry buys for price protection. Increased raw material stocks are bought for this reason, yet there is no immediate need for them, so that this buying has simply indicated an activity that is not real, and, in addition to creating a false activity, there is the hazard of obsolescence, damage, depreciation and the additional cost of storing and handling.

A serious problem of private enterprise is that of government competition. If this is to be continued the same method of cost accounting should be used by the government,

However, these are all internal problems viewed from the standpoint of the industry as a whole and are again not fundamental. Their solution would appear to be only a matter of time.

Down below the political, economic and social changes just discussed, the fundamental condition for recovery lies in increased sales. Wages cannot be paid unless there is work; profits cannot be made unless there are orders to fill; business cannot be increased unless there is initiative and enterprise.

When we study this fundamental necessity we find only a slightly encouraging situation. The volume of business done by electrical manufacturers in 1933 was greater than in 1932, but still it was not large enough to change the balance sheets from red to black for the large majority of companies. Sales of appliances and consumer devices were fair, but these sales were insufficient to offset the effect of a low volume of business in heavy electrical equipment, wiring supplies and engineering products. There is not yet a sufficient demand for energy to make an active market for more facilities in the utility field; building and factory construction or rehabilitation is not sufficiently active to create a profitable volume of business for electrical products in these fields; and in transportation, marine, mining and other markets the volume of business remains quite small. It is true that business has increased in these markets and apparently will continue to increase, but the rate is slow and the volume small.

Available markets outlined

Until there is another wave of expansion in this country that requires the building of many new structures, additions to factory production equipment and an extension or enlargment of utility systems it is evident that the business possibilities of electrical manufacturers lie in the so-called consumers goods:

1. Replacement and rehabilitation sales to existing markets.
2. Increased sales to the domestic market.
3. Development and sale of entirely new products.

I do not look for an expansion market in the near future, but I believe firmly that the present markets can support a profitable business volume for electrical manufacturers if sales are promoted properly and adequately made. We know the data on these markets. There is an enormous obsolescence market to be sold; from power station to a factory machine tool there is a field for sales by showing that modern equipment and assemblies are economically justified for replacement ot existing facilities. We know the enormous possibilities in the domestic electrical market for sales of appliances, lamps, wiring supplies and other devices. We know that several new products or services such as air conditioning have been produced recently that offer splendid sales opportunities. We have sufficient markets to be prosperous if we would sell them. We should do this and not be content to wait for the return of the former expansion era.

But to increase the volume of sales in these markets we must organize ourselves to fit the present markets. Costs and prices must be carefully scrutinized. Our sales staffs and our products face changed conditions in trying to sell a rehabilitation industrial market, for example, instead of the customary expansion market where sales consisted largely in competition in bidding for large orders for new factories. Now it is essential to study each market to get data whereby a replacement or an improvement can be justified to the industrial buyer before a sale can be made. This type of selling requires an increased sales expense and new sales methods. We must show the industrial purchaser that the use of more modern equipment and new methods will save him money on his existing volume of business before we can make sales. In order to do this at a minimum cost it will be necessary, in many instances, to work as a group of manufacturers to afford the essential data. Under the code we have a very efficient mechanism to develop ways and means for co-operative sales promotion of the type necessary to increase the volume of business in this market.

In the utility field, again, the first essential to sales is more load for the utilities so that they will buy equipment. In large measure industrial rehabilitation will increase the power load, for modernization tends to electrification. But another very promising field lies in the domestic market and the utilities and manufacturers can afford to intensify their individual and joint efforts to increase sales to this market. And in commercial light and power, in air conditioning and in transportation more load and more sales can be had through aggressive and intelligent sales efforts. It is to be hoped that the manufacturers and utilities will go after these business opportunities this year for this is the road to mutual prosperity.

Add to these opportunities the developments that have come from engineering and research laboratories during the depression years. Old products have been improved greatly and, in many instances, reduced in price. Many new products have been produced that can be used to advantage in industry. The manufacturers have contributed their best talents to equipment development and these new contributions can and will be sold to increase the business volume.

The electrical manufacturers are now a well-organized community. They are scattered as to location but organized as to function and action under the code. They can put their joint talents to work in administration, control, production and sales. They have their police force, their auditors, their divisional administrators and their rank and file of employees. The electrical manufacturers must use these assets effectively and in the public interest, and the coming year is certain to mark constructive action toward recovery and toward the consummation of the ideals that lie back of the new deal.

One of the tenets that has made N.E.M.A. successful has been the attitude that we must be our brother's keeper. This tenet is certainly the foundation on which this country is now building. This is no time for destructive criticism; constructive criticism, however, should be cordially received. We have gone through many stormy seas and more are ahead of us, but with the progress that has already been made and with the mistakes so far made obliterated; with the better co-operation of the government, capital, industry and labor, the country should certainly, in the near future, be on a safer, sounder and more permanent foundation than it has been in the past.

U. S. Census—1932

Toward the end of 1933 the Bureau of the Census began issuing preliminary reports on the results of the census of electric light and power companies for 1932. They indicate that the privately owned and municipal establishments, combined, were serving 23,858,411 customers, who during the year used nearly 65,900,000,000 kw.-hr. and paid slightly more than $1,821,000,000.

Total fixed capital, excluding that used in non-electrical operations, amounted to $12,664,376,952, of which 4.25 per cent was in municipal establishments. Capital stocks and long-term debt were roughly equal.

Physical plant included 4,350 generating stations with 47,966,000 hp. of prime movers, driving 34,624,000 kw. of generators. The year's generated output was 79,657,000,000 kw.-hr. These are round numbers. The exact figures, as announced, will be found in the tables on these pages.

The Census gives the first data in five years segregating the operations of commercial—that is, privately owned—and municipal establishments. The former greatly predominated in every respect except as to numbers. They had 90.5 per cent of the customers, sold 94.3 per cent of the energy and received 93.5 per cent of the revenue from ultimate consumers. These ratios differ but slightly from those of the 1927 census, in which they were, respectively, 90.3, 95.4 and 93.2 per cent.

Energy is most liberally used for domestic purposes in the Pacific region, where it averages 805 kw.-hr. annually per customer, and in the West North Central, 797 kw.-hr. The smallest regional average is 542 kw.-hr., in the Middle Atlantic states.

Comparison of the census statistics with those appearing elsewhere in this issue will reveal discrepancies, most of them relatively small, however. Because of the far-reaching changes that would have been involved not only in the figures for 1932, but also in those for 1933, it has not been found feasible to make the revisions until the census reports are complete. Partial revisions based only on the data thus far available would have led to discordant, and to a certain extent misleading, figures.

PRIME MOVERS, GENERATORS, OUTPUT

Commercial and Municipal Electric Light and Power Establishments by Geographical Regions*

United States Census for 1932 (preliminary figures) compared with 1927

Division		Establishments Reporting: Total number	Com-mercial	Muni-cipal	Establishments Reporting: Generating Eq'p't[1]	Distribution Only	Prime Movers: Total Number	Total Horsepower	Steam Turbines Number	Steam Turbines Horsepower	Steam Engines Number	Steam Engines Horsepower	Internal-combustion Engines Number	Internal-combustion Engines Horsepower	Hydro-turbines Number	Hydro-turbines Horsepower
United States	1932	3,429	1,627	1,802	1,867	1,628	11,182	47,965,990	2,821	32,904,258	1,300	648,501	3,276	866,312	3,785	13,546,919
	1927	4,335	2,137	2,198	2,331	2,004	12,030	35,710,128	2,864	24,323,304	2,267	994,273	3,177	548,288	3,722	9,844,263
Per cent increase		*—20.9*	*—23.9*	*—18.0*	*—23.2*	*—18.8*	*— 7.0*	*34.3*	*— 1.5*	*35.3*	*—42.7*	*—34.8*	*3.1*	*58.0*	*1.7*	*37.6*
New England	1932	304	224	80	144	167	923	3,643,604	221	2,360,268	57	48,813	52	13,459	593	1,221,064
	1927	341	258	83	170	179	943	3,009,090	240	2,177,370	102	68,492	23	4,705	578	758,523
Per cent increase		*—10.9*	*—13.2*	...	*—15.3*	*— 6.7*	*— 2.1*	*21.1*	*— 7.9*	*8.4*	*—44.1*	*—28.7*	...	*186.1*	*2.6*	*61.0*
Mid-Atlantic	1932	265	160	105	130	146	1,273	11,310,285	447	9,121,476	116	86,484	123	41,950	587	2,060,375
	1927	404	295	109	210	206	1,433	8,614,712	495	6,698,793	258	183,779	114	24,089	566	1,708,051
Per cent increase		*—34.4*	*—45.8*	*— 3.7*	*—38.1*	*—29.1*	*—11.2*	*31.3*	*— 9.7*	*36.2*	*—55.0*	*—52.9*	*7.9*	*74.1*	*3.7*	*20.6*
E. N. Central	1932	705	321	384	346	366	2,119	11,365,129	710	10,139,884	316	176,944	220	60,373	873	987,928
	1927	840	405	435	431	434	2,259	8,668,393	748	7,553,274	523	274,923	212	38,287	776	801,909
Per cent increase		*—16.1*	*—20.7*	*—11.7*	*—19.7*	*—15.7*	*— 6.2*	*31.1*	*— 5.1*	*34.2*	*—39.6*	*—35.6*	*3.8*	*57.7*	*12.5*	*23.2*
W. N. Central	1932	929	261	668	491	444	2,220	3,654,756	440	2,597,019	351	135,885	1,113	288,932	316	632,920
	1927	1,248	361	887	617	650	2,388	2,671,236	389	1,876,072	586	190,955	1,073	159,857	340	444,352
Per cent increase		*—25.6*	*—27.7*	*—24.7*	*—20.4*	*—31.7*	*— 7.0*	*36.8*	*13.1*	*38.4*	*—40.1*	*—28.8*	*3.7*	*80.7*	*— 7.1*	*42.4*
S. Atlantic	1932	381	175	206	193	207	1,193	6,129,902	325	3,179,278	108	28,202	291	87,773	469	2,834,649
	1927	515	223	292	312	220	1,394	4,393,793	362	2,556,135	252	73,895	298	64,570	482	1,699,193
Per cent increase		*—26.0*	*—21.5*	*—29.5*	*—38.1*	*— 5.9*	*—14.4*	*39.5*	*—10.2*	*24.4*	*—57.1*	*—61.8*	*— 2.3*	*35.9*	*— 2.7*	*66.8*
E. S. Central	1932	137	70	67	91	49	604	2,051,117	166	942,225	86	39,910	253	43,754	99	1,025,228
	1927	192	113	79	149	47	666	1,446,897	156	704,485	129	43,534	269	31,333	112	667,545
Per cent increase		*—28.6*	*—38.1*	...	*—38.9*	...	*— 9.3*	*41.8*	*6.4*	*33.7*	*—33.3*	*— 8.3*	*— 5.9*	*39.6*	*—11.6*	*53.6*
W. S. Central	1932	237	93	144	187	58	1,300	2,471,670	278	2,068,527	134	56,459	840	225,600	48	121,084
	1927	303	148	155	249	58	1,488	1,563,349	241	1,278,518	259	75,604	956	177,715	32	31,512
Per cent increase		*—21.8*	*—37.2*	*— 7.1*	*—24.9*	...	*—12.6*	*58.1*	*15.4*	*61.8*	*—48.3*	*—25.3*	*—12.1*	*26.9*	...	*284.2*
Mountain	1932	303	202	101	198	109	922	1,674,688	123	443,116	105	42,052	309	86,598	385	1,102,922
	1927	313	204	109	200	119	801	1,405,585	114	313,162	121	34,176	183	37,937	383	1,020,310
Per cent increase		*— 3.2*	*— 1.0*	*— 7.3*	*— 1.0*	*— 8.4*	*15.1*	*19.1*	*7.9*	*41.5*	*—13.2*	*23.0*	*68.9*	*128.3*	*0.5*	*8.1*
Pacific	1932	168	121	47	87	82	628	5,664,839	111	2,052,465	27	33,752	75	17,873	415	3,560,749
	1927	179	130	49	93	91	658	3,937,073	119	1,165,495	37	48,915	49	9,795	453	2,712,868
Per cent increase		*— 6.1*	*— 6.9*	...	...	...	*— 4.6*	*43.9*	*— 6.7*	*76.1*	...	*—31.0*	...	*82.5*	*— 8.4*	*31.3*

Division		Generators: Number	Generators: Kilowatt Capacity	Output of Stations (Kw.-Hr.)
United States	1932	11,108	34,624,068	79,657,431,657
	1927	11,967	25,811,305	74,686,378,010
Per cent increase		*— 7.2*	*34.1*	*6.7*
New England	1932	896	2,639,287	5,330,233,841
	1927	859	2,124,315	4,750,193,632
Per cent increase		*4.3*	*24.2*	*12.2*
Mid.-Atlantic	1932	1,262	8,271,338	20,340,794,839
	1927	1,457	6,373,454	19,281,644,834
Per cent increase		*—13.4*	*29.8*	*5.5*
E. N. Central	1932	2,015	8,247,748	18,106,043,305
	1927	2,225	6,245,084	18,211,894,585
Per cent increase		*— 9.4*	*32.1*	*—0.6*
W. N. Central	1932	2,226	2,614,975	5,357,876,862
	1927	2,400	1,950,096	4,549,263,907
Per cent increase		*— 7.3*	*34.1*	*17.8*
So. Atlantic	1932	1,195	4,290,917	9,458,694,089
	1927	1,414	3,144,019	8,445,216,788
Per cent increase		*—15.5*	*36.5*	*12.0*
E. S. Central	1932	613	1,480,254	2,993,770,456
	1927	666	1,049,765	2,777,268,044
Per cent increase		*— 8.0*	*41.0*	*7.8*
W. S. Central	1932	1,295	1,792,255	4,308,490,556
	1927	1,491	1,152,073	3,275,021,117
Per cent increase		*—13.1*	*55.6*	*31.6*
Mountain	1932	906	1,157,165	2,346,832,279
	1927	804	980,828	3,389,551,356
Per cent increase		*12.7*	*18.0*	*—30.8*
Pacific	1932	700	4,130,129	11,414,695,430
	1927	651	2,791,671	10,006,323,747
Per cent increase		*7.5*	*47.9*	*14.1*

*Corresponding statistics, by states, were published in the Electrical World, Oct. 14, 21 and 28, Nov. 4 and 11, 1933.

[1]Covers 4,350 generating stations for 1932 and 4,801 for 1927. (The term "Number of reporting establishments" refers to ownership or control; consequently, in many cases, a commercial establishment represents 2 or more generating stations or distributing systems.)

Includes 66 establishments reporting idle generating equipment for 1932 and 100 for 1927.

CUSTOMERS, ENERGY, REVENUE

Sales of Electric Light and Power Establishments—Ultimate Consumers Only

United States Census for 1932 (preliminary data)

Geographic Division and Class of Service	Number of Customers			Kilowatt-Hours Sold			Revenue from Electric Service, Dollars		
	Total	Commercial	Municipal	Total	Commercial	Municipal	Total	Commercial	Municipal
United States, total	**23,858,411**	**21,630,662**	**2,227,749**	**65,895,975,835**	**62,147,695,152**	**3,748,280,683**	**$1,821,105,524**	**$1,703,303,728**	**$117,801,796**
Farm service	613,753	592,692	21,061	1,504,257,106	1,488,105,684	16,151,422	42,773,826	41,874,996	898,830
Domestic service	19,285,560	17,337,876	1,947,684	11,790,139,511	10,410,749,374	1,379,390,137	649,764,750	584,995,286	64,769,464
Commercial service:									
Small light and power (retail)	3,527,794	3,284,326	243,468	12,059,463,977	10,793,767,814	1,265,696,163	491,852,492	459,440,913	32,411,579
Large light and power (wholesale)	379,402	365,038	14,364	32,380,076,220	31,931,212,851	448,863,369	483,390,649	475,738,880	7,651,769
Municipal street lighting	29,832	28,997	835	2,235,668,364	1,746,288,517	489,379,847	92,010,645	81,795,213	10,215,432
Railroads (motive power):[1]									
Street and interurban	474	454	20	4,392,943,247	4,348,207,607	44,735,640	38,777,175	38,296,902	480,273
Electrified steam divisions	367	363	4	762,204,863	762,115,347	89,516	7,018,519	7,015,342	3,177
Other service[1]	21,229	20,916	313	771,222,547	667,247,958	103,974,589	15,517,468	14,146,196	1,371,272
New England, total[1]	2,225,513	2,064,478	161,035	4,487,960,970	4,290,511,092	197,449,878	155,041,359	147,344,841	7,696,518
Farm service	40,321	38,219	2,102	26,731,155	25,310,858	1,420,297	1,680,334	1,614,277	66,057
Domestic service	1,846,408	1,702,520	143,888	1,018,599,909	924,346,000	94,253,909	62,068,256	57,406,456	4,661,800
Commercial, small (retail)	292,313	279,766	12,547	685,643,044	646,657,071	38,985,973	37,347,580	35,920,775	1,426,805
Commercial, large (wholesale)	43,371	41,002	2,369	2,340,427,359	2,299,536,717	40,890,642	41,059,073	40,152,762	906,311
Municipal street lighting	1,486	1,399	87	186,829,162	169,159,385	17,669,777	9,872,799	9,327,784	545,015
Middle Atlantic, total[1]	6,674,973	6,534,383	140,590	18,126,797,887	17,958,078,110	168,719,777	540,982,963	533,988,031	6,994,932
Farm service	106,292	104,965	1,327	80,131,973	78,618,899	1,513,074	5,090,967	5,011,649	79,318
Domestic service	5,426,456	5,298,865	127,591	2,941,969,660	2,865,333,570	76,636,090	184,734,611	180,343,584	4,391,027
Commercial, small (retail)	1,002,278	991,952	10,326	2,503,491,405	2,466,846,647	36,644,758	133,327,574	132,016,757	1,310,817
Commercial, large (wholesale)	126,948	125,702	1,246	10,281,037,183	10,249,531,218	31,505,965	166,447,518	165,771,225	676,293
Municipal street lighting	6,863	6,781	82	579,616,855	564,635,814	14,981,041	31,438,039	31,007,534	430,505
East North Central, total[1]	5,650,468	5,143,617	506,851	14,894,151,484	13,858,255,470	1,035,896,014	413,047,157	384,521,090	28,526,067
Farm service	190,342	181,282	9,060	138,503,155	131,664,470	6,838,685	8,958,614	8,624,040	334,574
Domestic service	4,606,737	4,161,222	445,515	2,854,607,790	2,538,154,490	316,453,300	148,707,155	134,080,222	14,626,933
Commercial, small (retail)	785,783	735,705	50,078	2,714,382,057	2,511,712,019	202,670,038	111,653,078	105,540,341	6,112,737
Commercial, large (wholesale)	53,496	51,684	1,812	6,754,168,165	6,605,987,060	148,181,105	107,208,093	104,879,899	2,328,194
Municipal street lighting	6,205	5,996	209	621,101,198	334,503,307	286,597,891	18,605,469	14,264,992	4,340,477
West North Central, total[1]	2,326,873	1,921,587	405,286	4,754,347,165	4,291,831,973	462,515,192	155,135,506	135,608,719	19,526,787
Farm service	54,522	50,090	4,432	43,463,857	40,300,812	3,163,045	3,608,114	3,380,583	227,531
Domestic service	1,870,141	1,510,757	359,384	1,119,104,614	878,526,654	240,577,960	63,093,732	50,316,419	12,777,315
Commercial, small (retail)	356,157	316,822	39,335	1,159,362,735	1,052,348,266	107,014,469	48,831,538	44,399,017	4,432,521
Commercial, large (wholesale)	40,865	39,030	1,835	1,829,158,903	1,749,673,095	79,485,808	27,740,939	26,608,263	1,132,676
Municipal street lighting	3,688	3,432	256	184,575,720	157,921,876	26,653,844	7,357,258	6,552,954	804,304
South Atlantic, total[1]	1,778,544	1,544,631	233,913	6,750,375,083	6,437,552,692	312,822,391	161,091,901	147,473,850	13,618,051
Farm service	43,481	41,039	2,442	40,530,849	38,647,654	1,883,195	2,229,448	2,109,255	120,193
Domestic service	1,450,253	1,243,269	206,984	998,436,263	845,848,593	152,587,670	55,255,142	46,866,888	8,388,254
Commercial, small (retail)	264,320	241,356	22,964	1,003,155,368	906,020,094	97,135,274	40,095,688	36,716,354	3,379,334
Commercial, large (wholesale)	15,275	13,845	1,430	4,111,300,352	4,082,639,359	28,660,993	51,562,059	50,910,689	651,370
Municipal street lighting	3,879	3,805	74	172,944,878	149,149,526	23,795,352	8,289,358	7,405,556	883,802
East South Central, total[1]	773,372	711,342	62,030	2,890,544,313	2,824,340,875	66,203,438	65,155,900	61,979,939	3,175,961
Farm service	20,514	20,131	383	17,413,499	17,097,546	315,953	1,135,576	1,116,632	18,944
Domestic service	602,211	545,592	56,619	354,666,271	314,398,734	40,267,537	21,405,330	19,077,167	2,328,163
Commercial, small (retail)	136,750	131,847	4,903	370,823,813	354,515,280	16,308,533	17,407,478	16,762,675	644,803
Commercial, large (wholesale)	11,309	11,206	103	1,892,893,835	1,890,517,407	2,376,428	20,619,512	20,547,848	71,664
Municipal street lighting	1,002	986	16	62,351,442	56,211,682	6,139,760	2,692,714	2,594,158	98,556
West South Central, total[1]	1,234,587	1,105,165	129,422	3,463,756,781	3,313,213,401	150,543,380	101,466,850	94,601,428	6,865,422
Farm service	12,948	12,118	830	31,344,441	30,982,179	362,262	1,239,326	1,211,856	27,470
Domestic service	962,744	846,896	115,848	532,273,196	450,418,464	81,854,732	34,680,407	29,987,240	4,693,167
Commercial, small (retail)	224,661	212,816	11,845	677,218,217	637,149,383	40,068,834	30,440,733	28,930,232	1,510,501
Commercial, large (wholesale)	28,480	27,626	854	1,839,160,531	1,823,249,828	15,910,703	28,715,928	28,363,896	352,032
Municipal street lighting	4,119	4,085	34	124,636,964	119,091,718	5,545,246	3,756,560	3,580,619	175,941
Mountain, total[1]	633,851	574,647	59,204	1,958,421,357	1,882,777,296	75,644,061	52,301,410	49,311,539	2,989,871
Farm service	32,893	32,513	380	74,979,089	74,417,363	561,726	2,186,224	2,165,626	20,598
Domestic service	489,441	438,683	50,758	336,370,267	300,520,749	35,849,518	17,876,711	16,125,671	1,751,040
Commercial, small (retail)	96,494	88,696	7,798	304,112,578	282,117,473	21,995,105	14,577,087	13,752,393	824,694
Commercial, large (wholesale)	14,063	13,847	216	1,067,815,691	1,057,170,838	10,644,853	14,097,558	13,870,776	226,782
Municipal street lighting	779	737	42	51,473,123	45,870,278	5,602,845	2,136,835	1,988,929	147,906
Pacific, total[1]	2,560,230	2,030,812	529,418	8,569,620,795	7,291,134,243	1,278,486,552	176,882,478	148,474,291	28,408,187
Farm service	112,440	112,335	105	1,051,159,088	1,051,065,903	93,185	16,645,223	16,641,078	4,145
Domestic service	2,031,169	1,590,072	441,097	1,634,111,541	1,293,202,120	340,909,421	61,943,406	50,791,639	11,151,767
Commercial, small (retail)	369,038	285,366	83,672	2,641,274,760	1,936,401,581	704,873,179	58,171,736	45,402,369	12,769,367
Commercial, large (wholesale)	45,595	41,096	4,499	2,264,114,201	2,172,907,329	91,206,872	25,939,969	24,633,522	1,306,447
Municipal street lighting	1,811	1,776	35	252,139,022	149,744,931	102,394,091	7,861,613	5,072,687	2,788,926

[1]Data for "Electrified steam divisions," "Street and interurban railways" and "Other service" not shown separately for the several geographic divisions, to avoid disclosure of individual operations, but included in geographic division totals.

Consolidated Balance Sheet for All Commercial Companies and for All Municipal Establishments, 1932

Assets

Kind	Commercial	Municipal*
Fixed capital,[1] total	$14,370,420,592	$613,076,599
Electric light and power	12,124,807,425	539,569,527
Electric railway	367,048,585	1,601,886
Gas	1,388,140,091	7,384,007
All other utilities	490,424,491	64,521,179
Investments	957,027,793	14,941,751
Current assets	943,026,889	64,836,005
Unamortized debt discount and expense	377,943,409	3,524,486
Other debit items	364,284,962[2]	13,171,992
Deficit	19,835,975	592,036
Total assets	$17,032,539,620	$710,142,869

Liabilities

Kind	Commercial	Municipal*
Capital stocks	$6,935,848,539	.....
Cash investments (for unincorporated companies)	6,867,895	$250,319,737
Long-term debt	6,678,761,901	208,975,676
Current liabilities	641,271,132	14,713,974
Retirement reserves	1,141,066,600	77,209,501
Other reserves	240,500,274	14,738,031
Other credit items	379,793,348[3]	19,034,968
Surplus	1,008,429,931	125,150,982
Total liabilities	$17,032,539,620	$710,142,869

[1]Plant and equipment, real estate, etc.
[2]Includes $35,120,680 reported as "advances to affiliated companies."
[3]Includes $106,038,491 reported as "advances from affiliated companies."

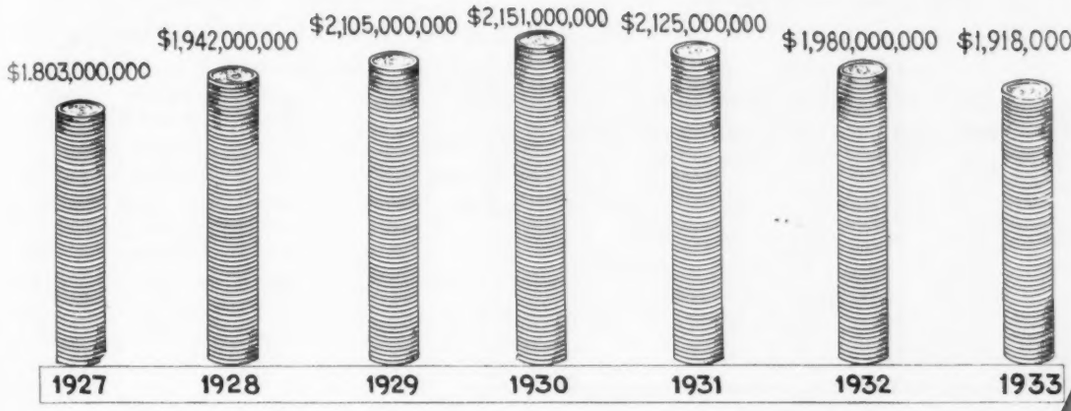
*The bookkeeping systems in most municipal plants do not include all the items of this balance sheet, or do not make possible complete or exact segregation of the details.

OUTSTANDING FACTS

Figures (*except as noted*) are on electric light and power industry for the year's operations or as of the end of each year.

	1922	1927	1928	1929	1930	1931	1932	[1]1933
CAPITAL invested ($1,000)	4,817,000	9,500,000	10,300,000	11,100,000	11,800,000	12,400,000	12,600,000	12,800,000
Securities sold ($1,000)	719,961	2,152,527	1,653,180	1,468,895	1,591,986	1,491,742	465,921	56,248
By investment houses ($1,000)	589,961	[3]1,889,000	[3]1,471,498	[3]1,315,459	[3]1,452,854	[3]1,341,742	[3]447,921	[3]55,873
Direct to customers ($1,000)	130,000	263,527	181,682	153,436	139,132	150,000	18,000	375
REVENUE, for elec. service ($1,000)	[4]1,020,439	1,802,655	1,941,955	2,105,900	2,151,150	2,125,110	1,979,990	1,917,800
From ultimate consumers ($1,000)	[4]945,428	1,661,032	1,784,309	1,938,520	1,990,955	1,975,944	1,832,596	1,777,900
Domestic ($1,000)	842,566	523,689	571,620	618,799	664,441	678,611	669,200	657,000
Small light and power ($1,000)		482,136	519,957	555,640	575,598	564,524	528,861	500,000
Large light and power ($1,000)		519,074	549,989	613,171	590,992	570,127	476,451	470,000
Municipal ltg. and misc. ($1,000)	49,151	82,996	90,695	98,646	107,841	114,045	113,952	108,900
Railways and railroads ($1,000)	48,444	53,137	52,048	52,264	52,083	48,637	44,132	42,000
Other sources ($1,000)	75,011	141,623	157,646	167,380	160,195	149,166	147,394	139,900
EXPENDITURES								
Additions and extensions ($1,000)	324,016	760,353	786,977	866,344	960,890	633,415	260,000	200,000
Operating, total[2] ($1,000)	553,068	828,168	866,350	934,890	946,180	913,910	833,580	810,490
Salaries and wages ($1,000)	212,433	390,000	.....	.....	.....	.....	323,875	.....
Taxes ($1,000)	73,128	157,000	178,000	187,500	203,500	210,000	217,000	.....
ENERGY (1,000,000 kw.-hr.)								
Output, all public utilities	*47,659*	*80,205*	*87,850*	*97,352*	*95,936*	*91,729*	*83,153*	*85,552*
Output, central stations only	43,560	74,686	82,927	91,421	89,952	86,312	77,868	80,092
From fuel	26,573	45,968	49,419	59,031	59,388	57,742	45,991	47,234
From water power	16,987	28,718	33,508	32,390	30,562	28,570	31,877	32,858
Total; incl. imported and purchased	44,422	76,369	83,394	92,757	91,957	88,400	79,505	82,560
SYSTEMS, STATIONS								
Number of establishments	6,355	4,335	4,063	[8]2,801	[8]2,755	[8]2,596	3,429	.....
Commercial establishments	3,774	2,137	2,153	[8]1,480	[8]1,379	[8]1,308	1,627	.....
Municipal establishments	2,581	2,198	1,910	[8]1,321	[8]1,376	[8]1,288	1,802	.....
Companies generating	4,389	2,331	2,394	[8]1,699	[8]1,575	[8]1,686	1,867	.....
Companies purchasing all energy	1,966	2,004	1,669	[8]1,102	[8]1,180	[8]910	1,628	.....
No. 100,000,000 kw.-hr. systems	6	124	135	137	142	142	138	.....
Transmission (circuit miles)	86,290	185,449	[9]173,797	[9]184,931	[9]200,171	[9]208,457	[9]208,097	.....
Generating plants, all central station	5,444	4,801	4,352	4,250	[8]3,873	[8]3,746	4,350	4,314
Commercial	3,615	3,589	3,232	3,190	2,863	.....	.....	.....
Municipal	1,820	1,207	1,120	1,060	1,010	.....	.....	.....
RATINGS								
Generator rating (kw.)	14,313,438	25,811,305	27,698,305	29,558,637	31,976,138	33,483,821	34,010,137	34,145,000
Prime movers (hp.)	20,296,235	35,710,128	38,544,800	41,551,800	44,747,000	47,112,000	[7]47,965,990	48,160,000
Steam engines and turbines (hp.)	14,171,222	25,317,577	27,360,000	29,512,000	31,540,000	32,250,000	[7]33,552,759	33,676,000
Water wheels (hp.)	5,822,018	9,844,263	11,119,800	11,439,000	12,540,000	14,155,000	[7]13,546,919	13,605,000
Internal combustion engines (hp.)	302,995	548,288	575,000	600,000	667,000	707,000	[7]866,312	879,000
Water power, all uses (hp.)	*8,270,000*	*12,296,000*	*13,571,530*	*13,807,778*	*14,884,667*	*15,562,805*	*15,817,941*	*15,875,000*
FUEL CONSUMPTION								
Coal and coke (short tons)	26,130,865	37,500,630	37,593,322	41,406,000	39,702,000	35,690,336	27,589,000	27,775,000
Oil (bbl.)	11,855,969	7,145,798	6,852,352	9,740,000	8,950,000	7,898,629	7,269,000	9,331,000
Gas (1,000 cu.ft.)	20,174,385	65,522,792	77,054,261	112,442,000	119,457,000	138,482,537	107,138,000	99,979,000
ENERGY DISPOSITION								
Sales, ult. users (1,000,000 kw.-hr.)	35,882	61,251	66,988	75,294	74,906	71,902	63,764	66,333
Domestic	9,560	7,676	8,619	9,773	11,018	11,738	11,987	11,940
Small power and light		10,766	11,692	13,106	13,944	13,544	12,932	12,470
Large power and light	20,620	35,263	38,903	44,326	41,621	38,451	31,186	34,380
Municipal lighting and misc.	[6]	2,003	2,223	2,450	2,735	2,994	2,944	2,900
Railways and railroads	5,642	5,543	5,551	5,640	5,588	5,175	4,715	4,640
Company railway depts.	.....	1,348	1,330	1,279	1,184	970	843	720
Company use and losses	8,600	13,770	15,077	16,184	15,867	15,528	14,898	15,510
CUSTOMERS AND EMPLOYEES								
Customers, total	12,709,868	21,786,212	23,153,252	24,147,183	24,555,732	24,489,770	24,149,300	24,126,926
Domestic lighting	10,211,232	17,950,934	19,089,882	19,967,154	20,331,551	20,151,247	19,849,963	19,843,724
Small light and power	2,030,324	3,358,140	3,532,489	3,598,115	3,628,653	3,724,013	3,687,636	3,689,204
Large light and power and other	468,312	477,138	530,881	581,914	595,528	614,510	611,701	593,998
People in electric lighted homes	43,100,000	75,500,000	80,300,000	84,000,000	84,700,000	85,500,000	85,000,000	85,000,000
Per cent of total population	38.9	63.0	67.5	70.0	70.0	70.0	69.0	68.3
Employees, total	150,762	251,020	†265,000	†289,000	†298,000	†262,000	244,573	†237,000

† Estimated.
[1] Estimated, generally on ten months' operations.
[2] Does not include interest, taxes, depreciation or sinking fund.
[3] Includes rights.
[4] Includes estimated value of free service, $5,267,000.
[6] Included in "Domestic" and "Small light and power."
[7] Census, preliminary.
[8] Very small ones omitted.
[9] 11,000 volts or over.



TOTAL REVENUE

Utility Records of 1933

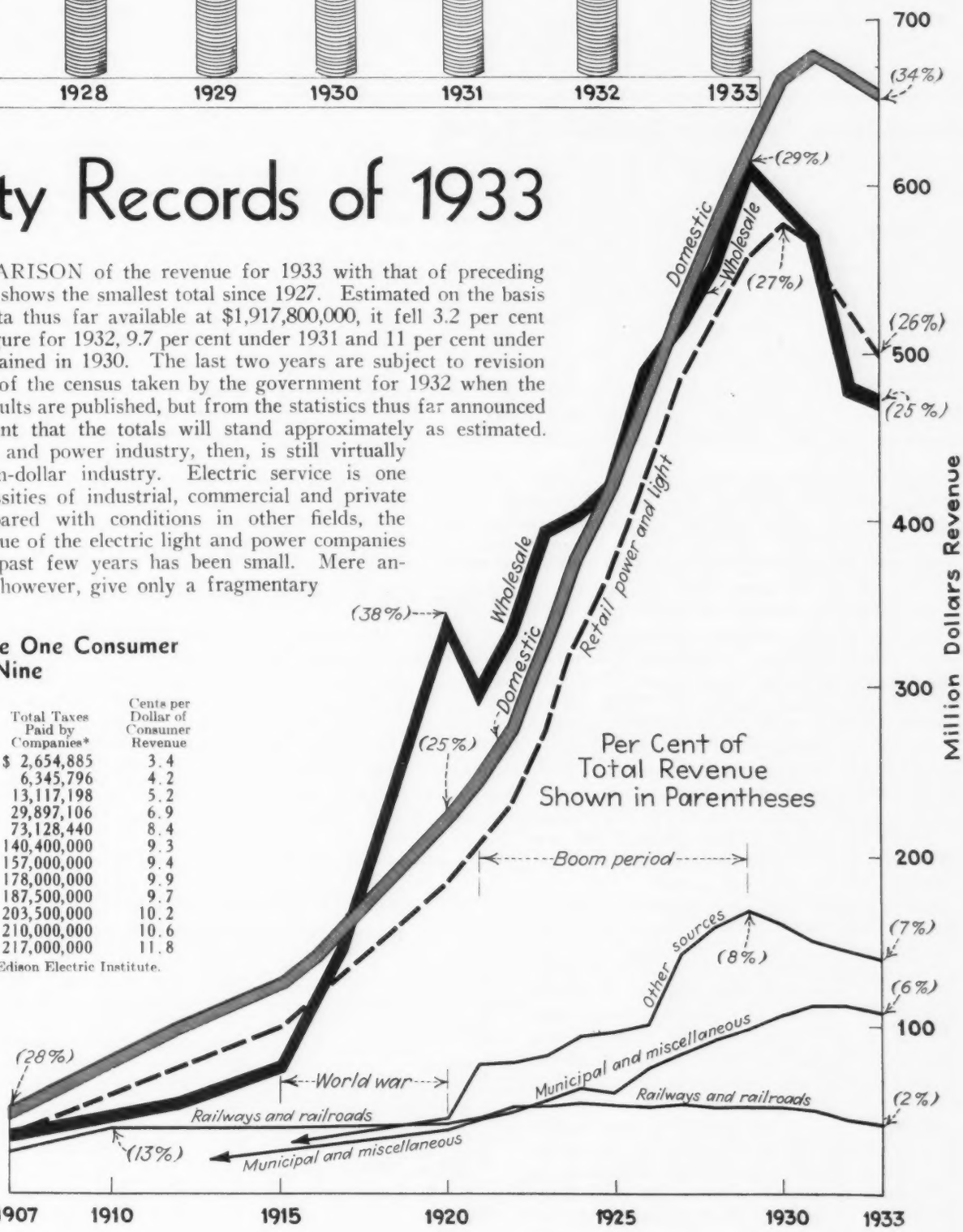
COMPARISON of the revenue for 1933 with that of preceding years shows the smallest total since 1927. Estimated on the basis of data thus far available at $1,917,800,000, it fell 3.2 per cent below the figure for 1932, 9.7 per cent under 1931 and 11 per cent under the peak attained in 1930. The last two years are subject to revision in the light of the census taken by the government for 1932 when the complete results are published, but from the statistics thus far announced it is apparent that the totals will stand approximately as estimated.

The light and power industry, then, is still virtually a two-billion-dollar industry. Electric service is one of the necessities of industrial, commercial and private life. Compared with conditions in other fields, the sag in revenue of the electric light and power companies during the past few years has been small. Mere annual totals, however, give only a fragmentary

Taxes Take One Consumer Dollar in Nine

Year	Total Taxes Paid by Companies*	Cents per Dollar of Consumer Revenue
1902	$ 2,654,885	3.4
1907	6,345,796	4.2
1912	13,117,198	5.2
1917	29,897,106	6.9
1922	73,128,440	8.4
1926	140,400,000	9.3
1927	157,000,000	9.4
1928	178,000,000	9.9
1929	187,500,000	9.7
1930	203,500,000	10.2
1931	210,000,000	10.6
1932	217,000,000	11.8

*Compiled by Edison Electric Institute.



Revenue of Electric Light and Power Companies, by Classes of Customers

(Expressed in $1,000,000)

Year	1927	1928	1929	1930	1931	1932	1933
Total	**1,803**	**1,942**	**2,106**	**2,151**	**2,125**	**1,980**	**1,918**
Total ultimate consumers	1,661	1,784	1,939	1,991	1,976	1,833	1,778
Domestic	524	572	619	664	679	669	657
Retail light and power	482	520	556	576	564	529	500
Wholesale light and power	519	550	613	591	570	477	470
Municipal and miscellaneous	83	90	99	108	114	114	109
Railways and railroads	53	52	52	52	49	44	42
Other sources*	142	158	167	160	149	147	140

*Company-owned railway departments, sales to other public utilities for resale, etc.

Central Station Revenue by Geographical Regions

(Expressed in $1,000,000. Due to round figures totals may not agree exactly with sum of items, but are correct)

	1912	1917	1922	1927	1928	1929	1930	1931	1932	1933
New England	29	53	101	157	170	186	189	190	184	182
Middle Atlantic	87	150	290	500	534	574	598	598	562	546
E. North Central	63	115	242	436	471	512	506	484	442	428
W. North Central	28	51	101	150	159	169	175	175	162	155
South Atlantic	16	30	75	170	181	194	201	203	191	189
E. South Central	8	14	31	69	74	80	81	80	74	70
W. South Central	12	19	43	96	110	128	134	128	120	113
Mountain	14	26	38	53	56	59	58	57	51	48
Pacific	31	45	99	173	187	203	208	210	194	187
United States	287	502	1,020	1,803	1,942	2,106	2,151	2,125	1,980	1,918

Revenue* Retrospect to 1902; Now, 11 per Cent Under Peak

Year	Revenue (Millions)	Year	Revenue (Millions)
1902	$84.2	1922	$1,020.4
1907	169.6	1923	1,180.9
1912	287.2	1924	1,322.0
1913	295.3	1925	1,425.2
1914	318.4	1926	1,621.6
1915	339.7	1927	1,802.7
1916	414.0	1928	1,942.0
1917	502.1	1929	2,105.9
1918	645.8	1930	2,151.2
1919	759.4	1931	2,125.1
1920	873.2	1932	1,980.0
1921	906.8	1933†	1,917.8

*Revenue for electric service, at five-year intervals from U. S. Census, for other years recomputed from earlier Electrical World figures to correspond. †Estimated on ten months' operations.

indication of what has been going on. They fail, for example, to reveal the fact that the deficiency in 1933, compared with 1932, was all accumulated during the first half of the year and that from July on the income began to surpass that of the preceding year. The margin was slight. It more than disappeared in October. Nevertheless the midyear marked a turn for the better.

But revenue has not been commensurate with energy sales. Rate reductions have occurred all along the line. The average domestic rate decreased from 5.58 cents per kilowatt-hour a year ago to 5.50 cents. The consumption in this class of service was about the same in both years, but the revenue fell off $12,000,000. And this happened in a year when users were thrifty. Toward the latter part of the year increments in use began to return. As this process continues, the additions of load are likely to be in the lower steps of the rate structure, and the average rate will decrease further.

In the wholesale group less revenue came in, despite an increase of 10 per cent in the amount of energy used. As the year progressed the speeding up of industrial activity was promptly reflected in the mounting output of power plants, but an obvious time-lag intervened before the downward trend in earnings was checked. The lag is normal, being introduced by the time required for reading meters, billing and the receipt of payment.

Regional changes responded to local industrial conditions and were greatly influenced by the nature of the predominant industries in various parts of the country. In New England, with its diversified small industries and relatively large domestic consumption, revenue was only 4 per cent less than the maximum, which came in 1931.

In the Mountain states, at the other extreme, the decrease approached 20 per cent, presumably in consequence of the severe curtailment in the mining of metals. Similarly, the influence of oil in the Southwest, of automobiles and steel and machinery in the Midwest and of the heavy industries in the Middle Atlantic states is readily apparent. On the Pacific Coast revenue fell 11 per cent under the maximum.

Energy Output Rises to 80,100,000,000 Kw.-Hr.

For the first time since 1929 the production of energy in central electric light and power plants has surpassed that of the year before. The total for the year was about 80,092,000,000 kw.-hr., of which 32,858,000,000 kw.-hr. came from water power and 47,234,000,000 kw.-hr. was generated from fuel. These figures involve some estimates and are therefore subject to revisions, which, however, will probably be small, when final returns have been compiled.

Distribution of Central-Station Energy

(Billion Kilowatt-Hours.)

	1927	1928	1929	1930	1931	1932	1933*
Generated	74.7	82.9	91.4	90.0	86.3	77.9	80.1
Total, including other sources	76.3	83.3	92.8	92.0	88.4	79.5	82.5
Electric railway departments	1.3	1.3	1.3	1.2	1.0	0.9	0.7
Other company use	1.1	1.2	1.2	1.3	1.3	1.2	1.9
Distributed	73.9	80.8	90.3	89.5	86.1	77.4	80.6
Total sold	61.3	67.0	75.3	74.9	71.9	63.7	66.3
Wholesale power	35.3	38.9	44.3	41.6	38.5	31.2	34.4
Retail light and power	10.8	11.7	13.1	14.0	13.5	12.9	12.5
Domestic	7.7	8.6	9.8	11.0	11.7	12.0	11.9
Railway and elec. railroads	5.5	5.6	5.6	5.6	5.2	4.7	4.6
Municipal and miscel	2.0	2.2	2.5	2.7	3.0	2.9	2.9
Losses	12.6	13.8	15.0	14.6	14.2	13.7	14.3

*Estimate based on ten months' operations.

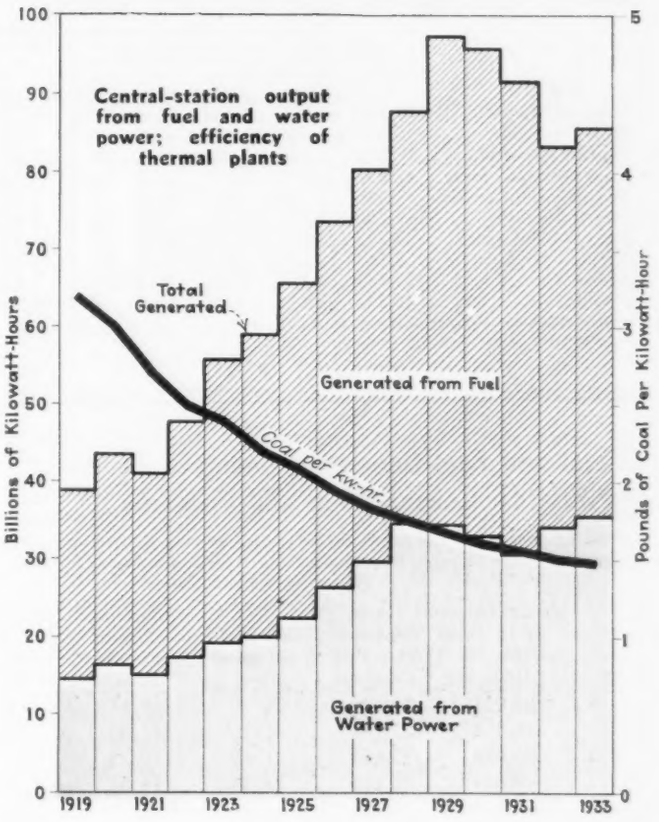
Compared with 1932, therefore, production increased about 3 per cent, and the rates of increase for water power and fuel-generated energy were about the same.

For the twelve-month period ended October 31 it has been possible to compile the actual figures, as shown in the table, "Energy Generated in Light and Power Plants." The totals are slightly less than those for the calendar year, given above, because of the gains in November and December.

The output curve for 1933 was abnormal. This has been evident from the chart published each week in ELECTRICAL WORLD. During the first four months production was less than in 1932, and was running 17 or 18 per cent under 1930. This was followed by an unprecedented rise in May and June, in two months almost wiping out the disparity compared with the best year on record. The rise stopped abruptly. Then, instead of the usual climb to a new winter record, which has been an invariable characteristic of normal years, a gentle decline set in and continued virtually to the end of the year. During the second half of the year the output was about the same as in 1931 and considerably more than in 1932.

Gains over 1932 were largely concentrated in the industrial areas—that is, along the Atlantic seaboard and in the group north of the Ohio River, together with the Mountain region. In the latter the gains during the second half year were extraordinary, running in some months as high as 25 per cent over 1932.

Wholesale energy sales began to mount in spring, and in July the excess over 1932 rose to 30 per cent. This was the maximum, the entire year's increase being 10 per cent. Railroad electrification also helped. Domestic and small commercial sales receded somewhat.



In the accompanying tables the output of central stations for electric light and power in 1932 is based on the monthly and annual reports of the United States

Energy Generated in All Classes of Electric Utilities by Region and State

Expressed in billion kilowatt-hours. Includes electric light and power, railway and other utilities. Figures are condensed from U. S. Geological Survey. Slight discrepancies between group totals and the sum of component items arise from contractions to eliminate final digits in the original data.

	1928	1929	1930	1931	1932	1933*
United States	**87.85**	**97.35**	**95.94**	**91.72**	**83.15**	**84.68**
New England	**5.96**	**6.61**	**6.40**	**6.39**	**5.72**	**5.97**
Maine	0.69	0.72	0.73	0.84	0.77	0.82
New Hampshire	0.30	0.31	0.37	0.59	0.70	0.63
Vermont	0.45	0.46	0.48	0.46	0.52	0.45
Massachusetts	2.75	3.03	2.91	2.74	2.44	2.55
Rhode Island	0.49	0.65	0.55	0.44	0.25	0.38
Connecticut	1.27	1.44	1.37	1.31	1.04	1.13
Middle Atlantic	**22.66**	**24.78**	**25.14**	**24.40**	**22.69**	**22.82**
New York	13.03	14.47	14.40	13.84	13.24	13.04
New Jersey	2.09	2.16	2.86	3.31	3.06	3.06
Pennsylvania	7.54	8.15	7.87	7.25	6.39	6.72
East No. Central	**20.95**	**23.33**	**22.16**	**20.64**	**18.17**	**18.58**
Ohio	5.54	6.42	5.94	5.56	4.96	5.29
Indiana	1.99	2.58	2.94	2.88	2.50	2.48
Illinois	6.97	7.37	6.85	6.33	5.45	5.55
Michigan	4.35	4.70	4.27	3.89	3.42	3.45
Wisconsin	2.11	2.28	2.16	1.98	1.84	1.81
West No. Central	**5.13**	**5.68**	**5.98**	**5.88**	**5.53**	**5.45**
Minnesota	1.07	1.20	1.31	1.30	1.15	1.14
Iowa	1.52	1.50	1.57	1.50	1.53	1.41
Missouri	0.99	1.22	1.27	1.31	1.21	1.28
North Dakota	0.085	0.105	0.125	0.137	0.137	0.116
South Dakota	0.106	0.108	0.114	0.102	0.088	0.085
Nebraska	0.46	0.53	0.57	0.60	0.55	0.54
Kansas	0.89	1.01	1.01	0.93	0.87	0.87
South Atlantic	**10.50**	**11.90**	**10.89**	**10.20**	**9.40**	**10.09**
Delaware	0.100	0.053	0.018	0.005	0.006	0.006
Maryland	1.48	2.01	1.87	1.70	1.69	1.83
D. of Columbia	0.47	0.51	0.55	0.58	0.61	0.49
Virginia	1.17	1.30	1.23	1.13	1.03	1.09
West Virginia	2.04	2.22	2.10	1.92	1.54	1.66
North Carolina	2.23	2.55	2.30	2.00	1.62	1.97
South Carolina	1.40	1.46	1.20	1.37	1.32	1.35
Georgia	0.98	1.14	0.94	0.84	0.98	1.10
Florida	0.64	0.67	0.69	0.65	0.61	0.61
East So. Central	**3.33**	**3.62**	**3.88**	**3.91**	**3.56**	**3.56**
Kentucky	0.63	0.72	0.72	0.75	0.68	0.67
Tennessee	0.96	1.02	1.04	1.12	1.04	1.00
Alabama	1.69	1.83	2.06	1.98	1.78	1.84
Mississippi	0.050	0.057	0.062	0.053	0.051	0.050
West So. Central	**4.04**	**4.90**	**5.05**	**4.50**	**4.15**	**4.22**
Arkansas	0.150	0.128	0.108	0.105	0.15	0.16
Louisiana	0.82	0.99	1.07	1.08	1.09	1.06
Oklahoma	0.84	0.98	0.96	0.78	0.71	0.72
Texas	2.22	2.80	2.92	2.53	2.21	2.28
Mountain	**3.92**	**3.97**	**3.70**	**3.27**	**2.53**	**2.68**
Montana	1.62	1.61	1.32	0.97	0.64	0.84
Idaho	0.95	0.89	0.91	0.80	0.58	0.59
Wyoming	0.084	0.099	0.098	0.095	0.085	0.083
Colorado	0.54	0.56	0.57	0.53	0.48	0.46
New Mexico	0.052	0.067	0.076	0.180	0.157	0.157
Arizona	0.34	0.28	0.38	0.40	0.28	0.29
Utah	0.28	0.40	0.29	0.28	0.28	0.24
Nevada	0.055	0.044	0.043	0.019	0.033	0.022
Pacific	**11.38**	**12.56**	**12.72**	**12.55**	**11.40**	**11.32**
Washington	2.36	2.55	2.56	2.57	2.49	2.44
Oregon	1.04	1.16	1.22	1.18	0.97	0.96
California	7.98	8.85	8.95	8.80	7.95	7.92

*Twelve months ended Oct. 31, 1933

Energy Generated in Light and Power Plants*

For *all* public utility plants see table below

Region	1932 Millions of Kw.-Hr. Total	1932 Millions of Kw.-Hr. Hydro	1932 Millions of Kw.-Hr. Fuel	1932 Per Cent Hydro	1932 Per Cent Fuel	1933† Millions of Kw.-Hr. Total	1933† Millions of Kw.-Hr. Hydro	1933† Millions of Kw.-Hr. Fuel	1933† Per Cent Hydro	1933† Per Cent Fuel
United States	**77,868**	**31,877**	**45,991**	**40.9**	**59.1**	**79,223**	**32,795**	**46,428**	**41.3**	**58.7**
New England	5,254	2,789	2,465	53.1	46.9	5,501	2,682	2,819	48.8	51.2
Middle Atlantic	19,897	5,942	13,955	29.9	70.1	20,007	6,248	13,759	31.2	68.8
East North Central	17,852	2,031	15,821	11.4	88.6	18,288	1,955	16,333	10.7	89.3
West North Central	5,326	1,525	3,801	28.6	71.4	5,255	1,486	3,769	28.2	71.8
South Atlantic	9,258	5,555	3,703	60.0	40.0	9,892	6,266	3,626	63.3	36.7
East South Central	3,262	2,692	570	82.5	17.5	3,221	2,682	539	83.3	16.7
West South Central	4,145	158	3,987	3.8	96.2	4,043	165	3,878	4.1	95.9
Mountain	2,341	1,775	566	75.8	24.2	2,481	1,955	526	78.8	21.2
Pacific	10,533	9,410	1,123	89.3	10.7	10,535	9,356	1,179	88.8	11.2

*By courtesy of the United States Geological Survey, with deductions for plants not considered light and power enterprises. †Twelve months ended Oct. 31.

Total and Fuel-Generated Energy With Coal Consumption and Economy

Including electric light and power, electric railway, Bureau of Reclamation and certain other plants generating energy for public consumption. (U. S. Geological Survey.) For light and power plants only see table above.

Year	Kw.-Hr. Generated in All Public Utility Plants (Millions)	Kw.-Hr. Generated from Fuel (Millions)	Coal Consumed (Millions of Tons)	Coal Equivalent on All Fuel† (Millions of Tons)	Pounds of Coal per Kw.-Hr.‡	Capacity End of Year (Kw.)
1919	38,921	24,176	35.10	38.88	3.2	13,093,972
1920	43,555	27,248	37.13	41.43	3.0	14,399,052
1921	40,976	25,863	31.59	35.25	2.7	15,482,526
1922	47,659	30,240	34.18	38.01	2.5	15,970,787
1923	55,674	36,092	38.96	43.53	2.4	17,369,127
1924	59,014	38,808	37.56	43.14	2.2	19,519,000
1925	65,870	42,264	40.23	44.79	2.1	23,618,762
1926	73,791	47,274	41.32	45.86	1.95	25,398,385
1927	80,205	50,330	41.88	45.91	1.84	27,690,891
1928	87,850	53,154	41.35	46.39	1.76	29,629,702
1929	97,352	62,723	44.94	52.57	1.69	31,952,396
1930	95,936	62,915	42.90	50.65	1.62	34,263,944
1931	91,729	61,126	38.73	47.13	1.55	35,590,072
1932	83,153	49,055	30.29	36.60	1.50	36,060,593
1933*	85,552	50,010	30.33	36.90	1.48	36,205,245

*Estimated on basis of 10 months' operations.
†Includes oil and natural gas, but not wood.
‡Excluding output from wood-burning plants.

Energy Output From the Beginning

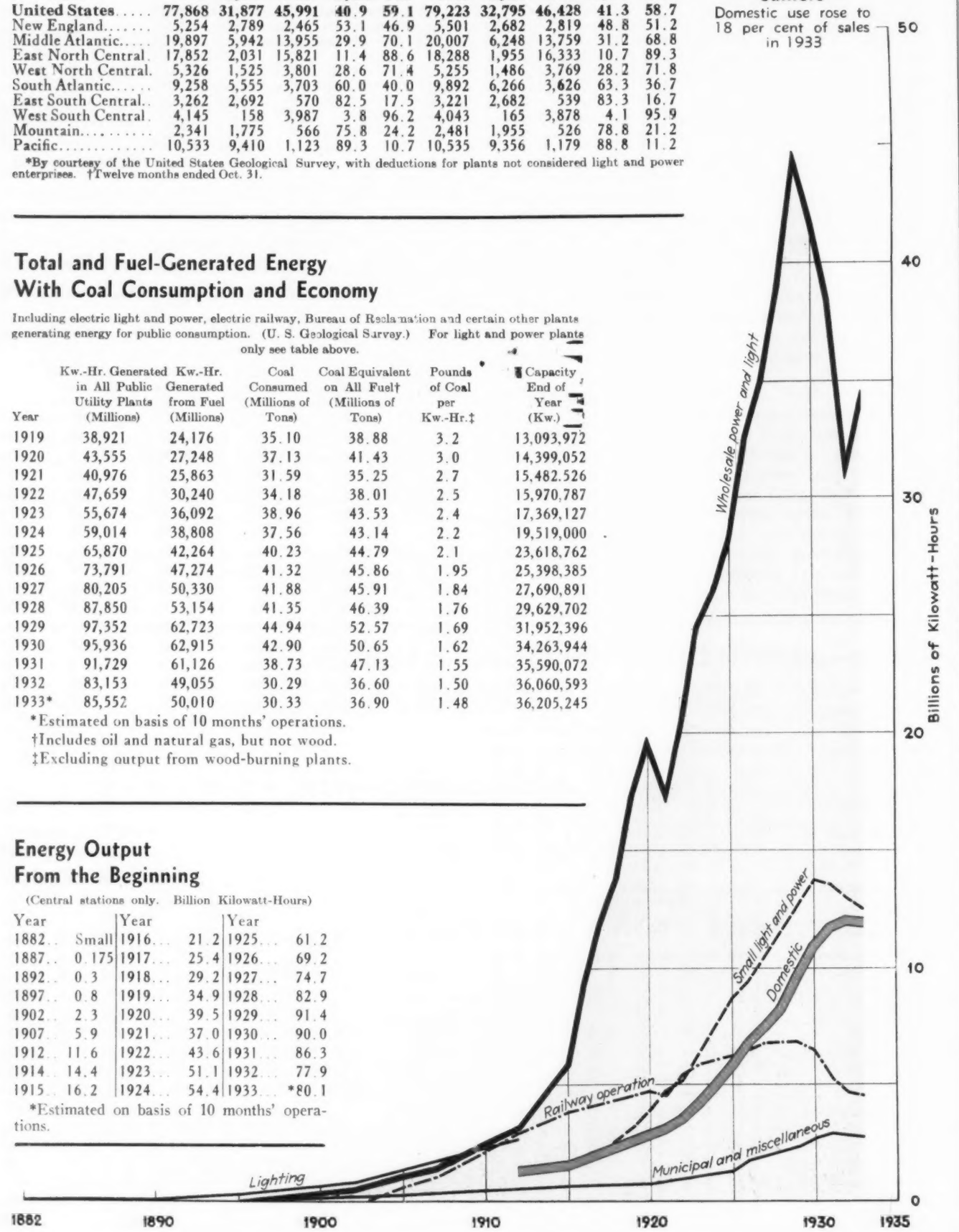
(Central stations only. Billion Kilowatt-Hours)

Year		Year		Year	
1882	Small	1916	21.2	1925	61.2
1887	0.175	1917	25.4	1926	69.2
1892	0.3	1918	29.2	1927	74.7
1897	0.8	1919	34.9	1928	82.9
1902	2.3	1920	39.5	1929	91.4
1907	5.9	1921	37.0	1930	90.0
1912	11.6	1922	43.6	1931	86.3
1914	14.4	1923	51.1	1932	77.9
1915	16.2	1924	54.4	1933	*80.1

*Estimated on basis of 10 months' operations.

Central Station Energy Sales, by Class of Consumers

Domestic use rose to 18 per cent of sales in 1933



Geological Survey, and 1933 is on the same basis. The figures for 1932 differ somewhat from those announced by the Bureau of the Census, reproduced elsewhere in this issue. The difference is presumably due to diverse decisions as to the inclusion of borderline cases, for instance, plants of which part of the output is used directly in manufacturing and part of it sold for light and power.

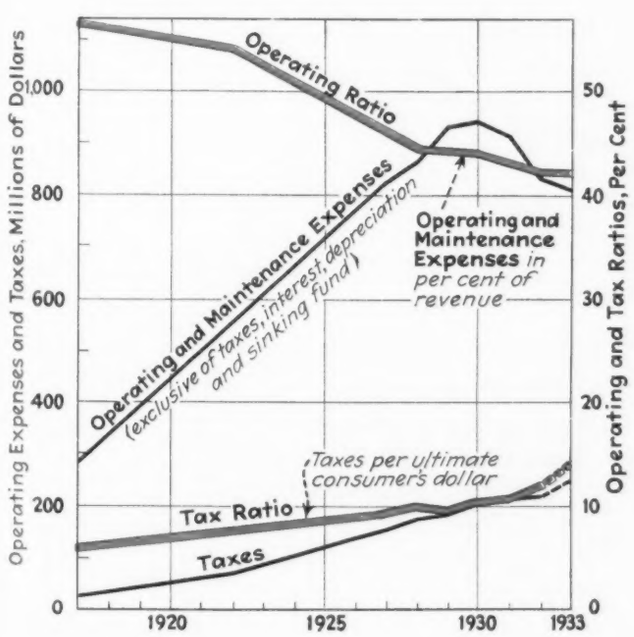
More comprehensive data are also given under captions indicating that they refer to all electric public utilities, of which, however, central station operations constitute about 94 per cent.

Output from water power, 35,540,000,000 kw.-hr., contributed fully 41 per cent of the total. This not only constituted an unusually large fraction of the whole production, but marks the high point thus far of hydroelectric power production in the United States. The excess over 1928, the previous high year, was around 900,000,000 kw.-hr.

Efficiency of production from fuel was again improved, the average consumption falling to 1.48 lb. of coal per kw.-hr. This is only 46 per cent of the 3.2 lb. used in 1919. At the earlier rate 80,000,000 tons of coal or its equivalent would have been burned, instead of the 36,900,000 tons actually consumed in 1933.

Operating and Maintenance Costs Held Down

In step with the decreasing income, proportionate reductions were effected during 1933 in the operating and maintenance expenses of electric light and power companies. These expenses, amounting to $810,500,000, exclusive of interest, taxes, depreciation or sinking fund charges, consumed 42 per cent of the total revenue for electric service, or about the same fraction as in 1932. They reached their highest figure, $946,180,000, in 1930, and have since shown an annual decrease. Much of this can probably be ascribed to smaller fuel bills. Aside from lower prices much less fuel has been used during the past few years. Coal consumption in central stations was fully 13,000,000 tons less in 1933 than in 1929.



Operating and Maintenance Expenses of Light and Power Companies

(Expressed in $1,000,000)

Exclusive of taxes, interest on debt, depreciation and sinking fund

	United States	New England	Atlantic	North Central	South Central	Mountain Pacific
1917.....	**284.8**	29.7	107.8	99.6	17.6	30.1
1922.....	**553.0**	57.7	202.7	197.0	39.1	56.5
1927.....	**828.2**	71.2	308.2	282.9	85.8	80.1
1928.....	**866.3**	75.6	327.3	280.8	91.4	91.2
1929.....	**934.9**	79.7	340.4	315.6	102.9	96.3
1930.....	**946.2**	79.6	350.4	311.8	105.4	99.0
1931.....	**913.9**	76.9	345.8	294.9	96.8	99.5
1932.....	**833.6**	70.0	320.1	267.8	85.9	89.8
1933*.....	**810.5**	68.6	312.5	261.4	81.9	86.1

*Estimate based on ten months' operations.

Taxes meanwhile have been steadily and rapidly rising. In 1932 they came to $217,000,000, according to a compilation by the Edison Electric Institute. This was nearly 12 cents out of each dollar received from ultimate consumers. The amount paid in 1933 will be considerably larger. Taking into account the additional taxes that have been levied, including the transfer of the 3 per cent tax from the consumers to the companies, the estimate for that year points to a total of $250,000,000. This is equivalent to 14 cents out of each consumer dollar, on the basis of $1,777,900,000 received from ultimate consumers.

▼

The Outlook for 1934

By GERARD SWOPE

President General Electric Company

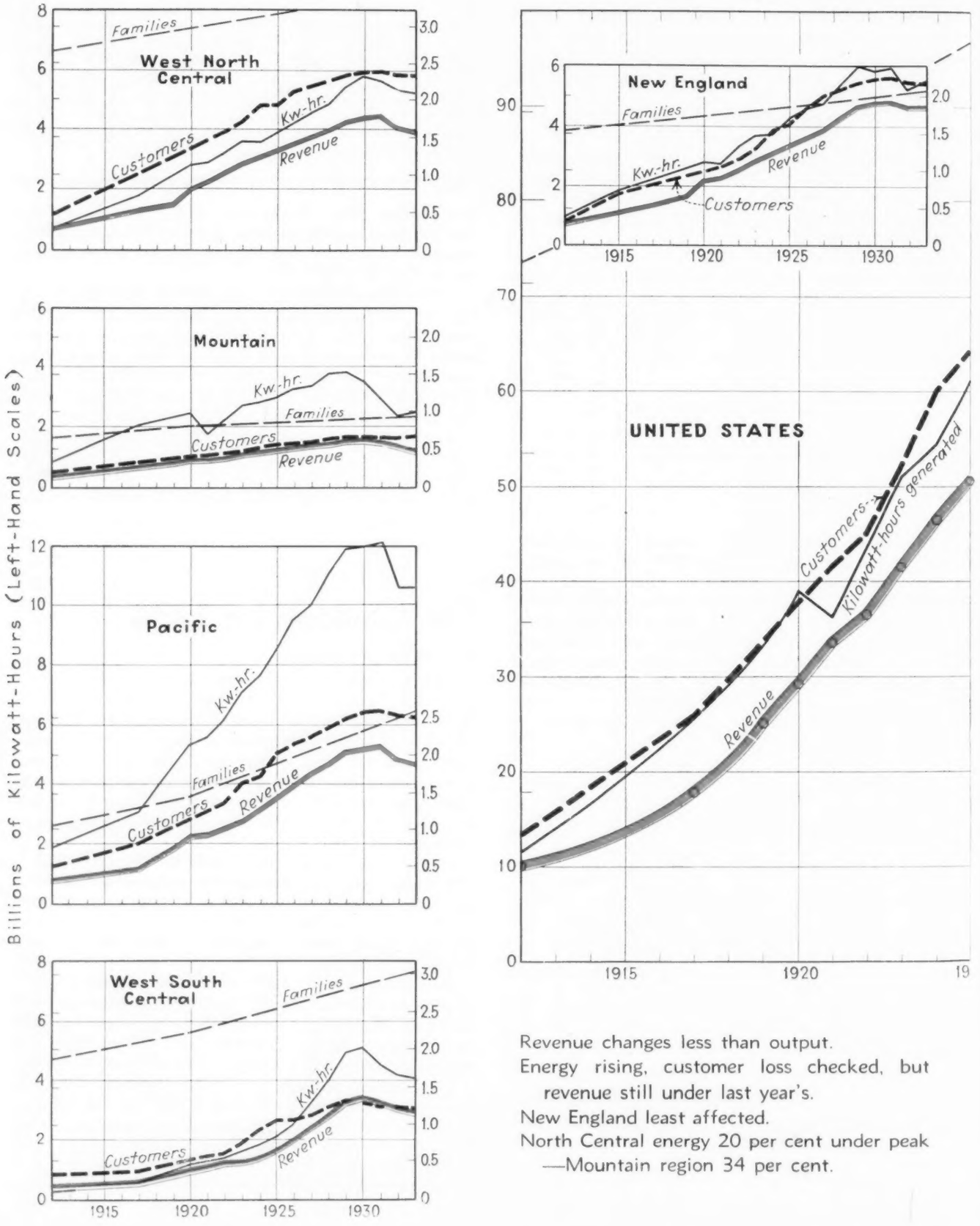
THESE are difficult times to prognosticate and possibly it is human to turn to past prophecies, especially when they have turned out fairly well. Last year I stated that the indices of use of power and revenue carloadings showed a continued upward trend and that therefore we were hopeful that this upward trend would continue.

If the same indices are continued through 1933, it will be seen that for the quarter ended June 30, 1933, the three crossed the line and have been distinctly upward since. The fourth quarter has gone down from the high point, but is still better than for the same period in 1932.

Now with codes of fair competition adopted in many of the industries, with the increased employment and increased purchasing power that has been brought about, these activities naturally and undoubtedly will cause some increase in prices to the ultimate consumer.

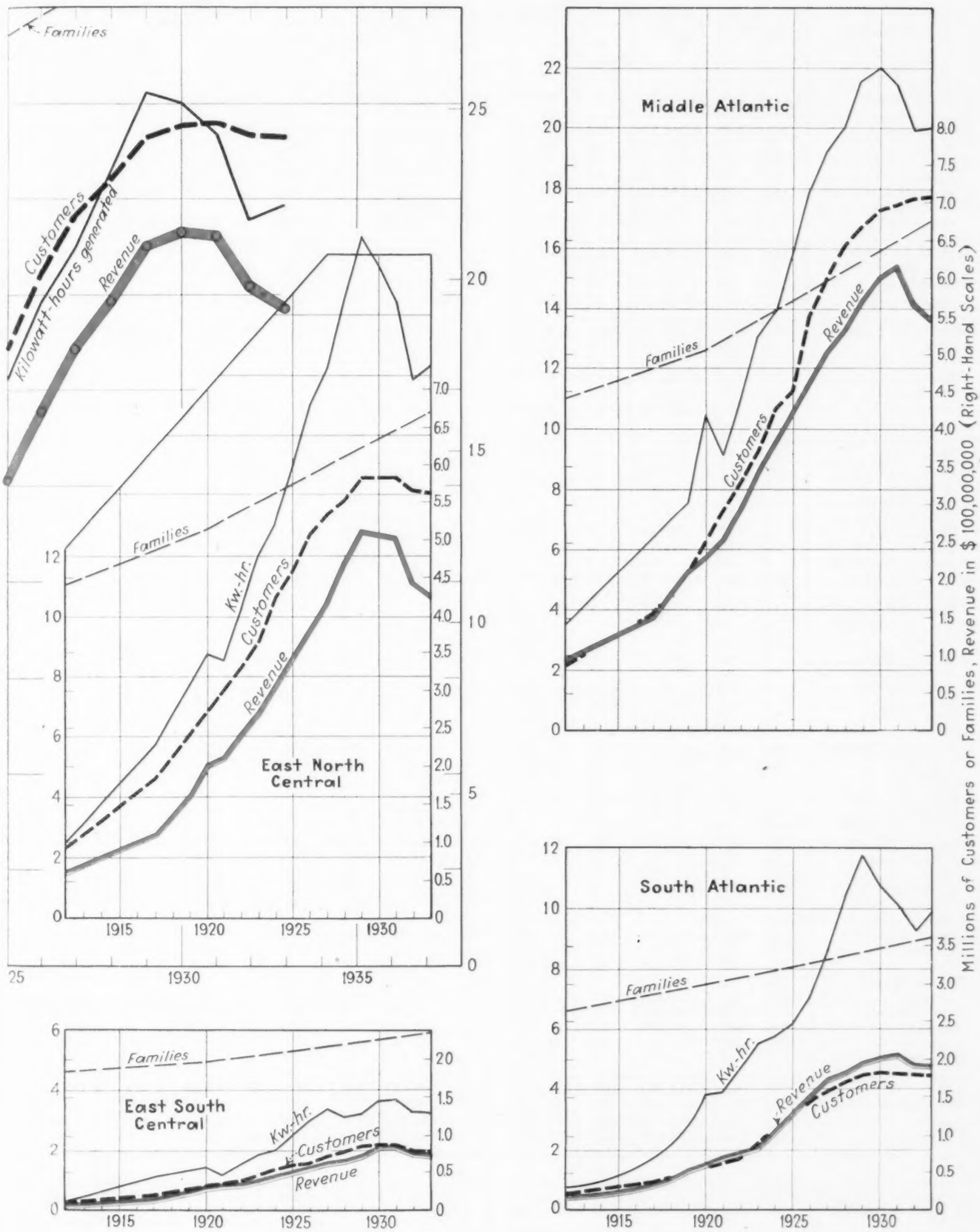
The problem of today is to have a greater revival in the capital goods industry, which has felt the increase but little, and with all the experiments that are being made and the hopeful and constructive attitude being shown, we are looking forward with confidence that 1934 will be a better year than 1933 in employment and in industry.

CUSTOMERS, OUTPUT, REVENUE IN



Revenue changes less than output.
Energy rising, customer loss checked, but revenue still under last year's.
New England least affected.
North Central energy 20 per cent under peak —Mountain region 34 per cent.

NINE GEOGRAPHICAL REGIONS



CAPACITY OF GENERATORS in Public Utility Power Plants*

November, 1933—By Courtesy of United States Geological Survey

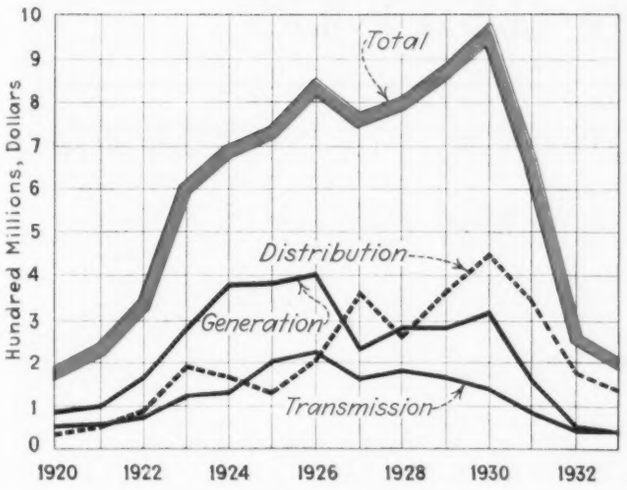
Division and State	Companies†	Plants	Total Capacity, Kw.	Generator Capacity of Plants Operated By									
				One Type of Prime Mover						Combination of Two or More Types			
				Water Power		Steam Power		Internal comb. Engines		Total		Water Power	Steam Power	Int. Comb. Engines
				No.	Kw.	No.	Kw.	No.	Kw.	No.	Kw.	Kw.	Kw.	Kw.
United States	**1,542**	**3,828**	**36,205,245**	**1,353**	**9,498,163**	**1,390**	**25,374,175**	**795**	**374,902**	**290**	**958,005**	**269,080**	**568,333**	**120,592**
New England	**144**	**329**	**2,961,177**	**213**	**787,959**	**79**	**2,035,440**	**6**	**6,311**	**31**	**131,467**	**25,533**	**103,490**	**2,444**
Maine	27	78	261,602	66	208,425	6	49,730	1	557	5	2,890	1,446	900	544
New Hampshire	13	51	280,828	36	217,753	6	37,455	1	480	8	25,140	4,150	20,050	940
Vermont	26	72	178,483	62	161,871	4	11,200	0	0	6	5,412	2,502	2,910	0
Massachusetts	53	80	1,348,109	25	119,730	44	1,151,575	3	4,049	8	72,755	14,755	57,040	960
Rhode Island	3	7	242,950	3	1,750	4	241,200	0	0	0	0	0	0	0
Connecticut	22	41	649,205	21	78,430	15	544,280	1	1,225	4	25,270	2,680	22,590	0
Middle Atlantic	**154**	**426**	**9,195,069**	**202**	**1,352,372**	**172**	**7,637,040**	**21**	**23,842**	**31**	**181,815**	**129,380**	**37,490**	**14,945**
New York	80	260	5,422,073	166	1,136,732	71	4,244,210	5	12,408	18	28,723	10,565	4,435	13,723
New Jersey	12	25	1,064,305	3	950	17	1,053,700	2	1,740	3	7,915	5,100	2,700	115
Pennsylvania	62	141	2,708,691	33	214,690	84	2,339,130	14	9,694	10	145,177	113,715	30,355	1,107
East North Central	**301**	**682**	**8,248,333**	**262**	**623,220**	**337**	**7,373,404**	**38**	**22,485**	**45**	**229,224**	**22,290**	**195,358**	**11,576**
Ohio	66	105	2,160,617	8	10,380	87	2,073,907	6	2,010	4	74,320	2,770	71,350	200
Indiana	52	105	1,038,037	18	29,770	79	996,000	6	5,592	2	6,675	3,200	3,260	215
Illinois	59	110	2,546,438	14	42,315	81	2,414,199	9	4,204	6	85,720	5,535	77,905	2,280
Michigan	62	185	1,643,340	117	302,037	46	1,321,100	11	4,633	11	15,570	2,537	7,285	5,748
Wisconsin	62	177	859,901	105	238,718	44	568,198	6	6,046	22	46,939	8,248	35,558	3,133
West North Central	**359**	**738**	**2,668,113**	**113**	**465,855**	**263**	**1,924,677**	**291**	**130,710**	**71**	**146,871**	**12,113**	**101,379**	**33,379**
Minnesota	60	125	583,402	43	151,850	56	418,320	14	5,724	12	7,508	2,338	2,762	2,408
Iowa	66	152	590,465	26	146,600	67	342,298	43	23,160	16	78,407	3,903	67,261	7,243
Missouri	57	102	707,570	8	150,005	39	528,122	47	23,829	8	5,614	0	1,879	3,735
North Dakota	14	34	74,779	0	0	18	69,923	15	4,306	1	550	0	250	300
South Dakota	24	54	66,809	5	4,200	12	36,665	34	12,953	3	12,991	0	9,020	3,971
Nebraska	65	142	248,094	23	6,785	39	203,898	60	20,285	20	17,126	3,905	3,713	9,508
Kansas	73	129	396,994	8	6,415	32	325,451	78	40,453	11	24,675	1,967	16,494	6,214
South Atlantic	**165**	**436**	**4,358,993**	**148**	**1,886,006**	**166**	**2,305,385**	**91**	**41,488**	**31**	**126,114**	**41,979**	**76,454**	**7,681**
Delaware	6	6	8,515	0	0	4	7,600	2	915	0	0	0	0	0
Maryland	14	26	618,717	4	271,980	13	342,640	8	2,997	1	1,100	0	300	800
Dist. of Columbia	3	3	228,900	1	2,400	2	226,500	0	0	0	0	0	0	0
Virginia	26	73	456,657	34	81,984	18	294,949	12	4,173	9	75,551	14,973	59,790	788
West Virginia	18	42	563,145	6	55,920	24	501,670	9	4,511	3	1,044	535	62	447
North Carolina	30	82	996,972	47	640,087	23	342,925	7	4,219	5	9,741	6,291	2,000	1,450
South Carolina	18	48	654,431	24	489,738	17	141,521	3	440	4	22,732	16,200	6,202	330
Georgia	16	64	466,715	29	329,647	29	128,454	4	1,134	2	7,480	3,780	3,500	200
Florida	34	92	364,941	3	14,250	36	319,126	46	23,099	7	8,466	200	4,600	3,666
East South Central	**79**	**218**	**1,672,777**	**32**	**881,506**	**97**	**725,719**	**75**	**22,309**	**14**	**43,243**	**23,415**	**17,062**	**2,766**
Kentucky	20	46	342,327	3	104,860	31	234,322	6	1,005	6	2,140	315	975	850
Tennessee	27	63	425,898	19	186,596	27	197,052	13	3,168	4	39,082	23,100	15,390	592
Alabama	10	37	839,590	10	590,050	16	245,475	11	4,065	0	0	0	0	0
Mississippi	22	72	64,962	0	0	23	48,870	45	14,071	4	2,021	0	697	1,324
West South Central	**135**	**391**	**1,749,367**	**20**	**91,635**	**129**	**1,506,181**	**214**	**100,430**	**28**	**51,121**	**1,080**	**30,769**	**19,272**
Arkansas	18	58	147,511	5	66,855	30	72,386	19	4,666	4	3,604	0	1,294	2,310
Louisiana	28	55	312,069	0	0	13	291,565	40	19,079	2	1,425	0	712	713
Oklahoma	46	94	336,070	2	1,500	29	300,675	55	28,935	8	4,960	200	1,747	3,013
Texas	43	184	953,717	13	23,280	57	841,555	100	47,750	14	41,132	880	27,016	13,236
Mountain	**126**	**312**	**1,196,854**	**155**	**781,734**	**83**	**356,712**	**47**	**19,265**	**27**	**39,143**	**8,961**	**4,951**	**25,231**
Montana	8	30	310,599	17	299,610	7	7,863	3	1,448	3	1,678	268	445	965
Idaho	18	45	226,605	38	220,315	3	1,100	0	0	4	5,190	4,180	0	1,010
Wyoming	20	35	43,527	8	15,580	17	24,307	9	2,940	1	700	400	300	0
Colorado	26	67	236,025	21	53,942	33	174,641	8	4,998	5	2,444	1,469	100	875
New Mexico	15	27	85,503	1	200	13	77,011	9	3,841	4	4,451	808	1,617	2,026
Arizona	16	41	142,606	11	87,050	9	30,790	15	4,573	6	20,193	0	2,489	17,704
Utah	19	57	141,562	52	96,142	1	41,000	1	465	3	3,955	1,740	0	2,215
Nevada	4	10	10,427	7	8,895	0	0	2	1,000	1	532	96	0	436
Pacific	**79**	**296**	**4,154,562**	**208**	**2,627,876**	**64**	**1,509,617**	**12**	**8,062**	**12**	**9,007**	**4,329**	**1,380**	**3,298**
Washington	30	80	918,811	50	722,029	20	192,352	2	173	8	4,257	2,299	880	1,078
Oregon	21	66	336,119	41	174,704	16	154,990	5	1,675	4	4,750	2,030	500	2,220
California	28	150	2,899,632	117	1,731,143	28	1,162,275	5	6,214	0	0	0	0	0

*The table relates to all public utility plants of 100 kw. or larger. This is a more comprehensive classification than electric light and power; it embraces also electric railway and other plants generating energy used for public utility purposes.

The omission of the very small plants does not appreciably affect the aggregate rating or output. In 1927 these numbered about 1,000, in 1932 only about 600.

The number of small operating companies or establishments correspondingly omitted in 1932 was somewhat over 400.

†Only companies that have generating plants. Excludes those purchasing all their energy. Includes municipalities.



Utility Budgets Small

With comparatively little new building going on during the past two years capital expenditures dropped to a low ebb. The raising of new money almost came to a dead stop in 1933. But some additions to physical plant were nevertheless made, financed in part out of surplus.

In the absence of exact figures the amounts can only be estimated; for 1933 a total of $200,000,000 may be taken as a fair approximation. Such modest additions as were made to power plant equipment absorbed about $35,000,000, the larger part of it in steam plants. No attempt has been made to allocate these items by geographical regions.

Under existing conditions the compiling of budgets for 1934 would be meaningless. Any figures given at this time must be candidly recognized as little better than a guess, but indications point to something on the order of $250,000,000 as being at least a reasonable probability. In addition to these expenditures it is estimated that governmental subsidized utility expenditures will add another $100,000,000.

Total Capital Expenditures

(Thousands of Dollars)

Year	Total	Generating Plants	Transmission, Distribution	Miscellaneous
1926	$841,344	$400,107	$441,237	.....
1927	760,353	234,883	525,470	.....
1928	786,978	284,874	453,796	48,308
1929	866,344	281,460	528,896	55,988
1930	960,889	325,296	569,655	65,938
1931	633,415	162,843	428,797	41,775
1932	260,000	46,000	199,000	15,000
1933	200,000	35,000	155,000	10,000

Expenditures by Sections

(Thousands of Dollars)

Year	Eastern Section	Southern Section	No. Central Section	Western Section
1926	$200,107	$190,500	$280,605	$170,132
1927	247,961	191,190	213,994	107,208
1928	253,277	182,322	244,060	107,319
1929	265,847	176,585	293,564	130,348
1930	308,597	194,396	318,097	139,800
1931	201,696	114,035	208,642	109,042
1932	88,600	42,800	79,000	49,600
1933	.....	.....	.....	.....

EXPENDITURES BY KIND OF CONSTRUCTION

Steam Power Plant Expenditures

(Thousands of Dollars)

Year	Eastern	Southern	No. Central	Western	Totals for U. S.
1926	$80,107	$30,000	$120,000	$25,000	**$255,107**
1927	53,593	35,128	43,585	13,711	**146,017**
1928	49,841	45,537	58,749	16,906	**171,033**
1929	53,891	37,600	75,299	15,758	**182,548**
1930	56,226	35,868	94,013	21,794	**207,901**
1931	28,582	14,396	41,731	11,437	**96,147**
1932	13,800	4,700	15,100	6,400	**40,000**
1933	.....	.....	.....	.....	**25,000**

Transmission Expenditures

(Thousands of Dollars)

Year	Eastern	Southern	No. Central	Western	Totals for U. S
1926	$50,000	$60,456	$60,605	$60,000	**$231,061**
1927	32,147	47,830	61,055	22,121	**163,153**
1928	71,097	28,999	67,519	18,575	**186,190**
1929	44,015	35,059	60,589	27,902	**167,565**
1930	42,601	29,912	48,910	15,662	**137,085**
1931	25,966	11,881	24,096	18,969	**80,913**
1932	12,600	5,400	11,600	12,400	**42,000**
1933	.....	.....	.....	.....	**35,000**

Hydro Plant Expenditures

(Thousands of Dollars)

Year	Eastern	Southern	No. Central	Western	Totals for U. S.
1926	$20,000	$60,000	$20,000	$45,000	**$145,000**
1927	39,436	21,913	6,020	21,497	**88,866**
1928	38,717	43,926	8,610	22,588	**113,841**
1929	28,784	21,575	25,071	23,482	**98,912**
1930	36,461	24,181	17,746	39,007	**117,395**
1931	27,949	6,547	10,932	21,266	**66,695**
1932	1,400	500	1,200	2,900	**6,000**
1933	.....	....	.....	.....	**10,000**

Distribution Expenditures

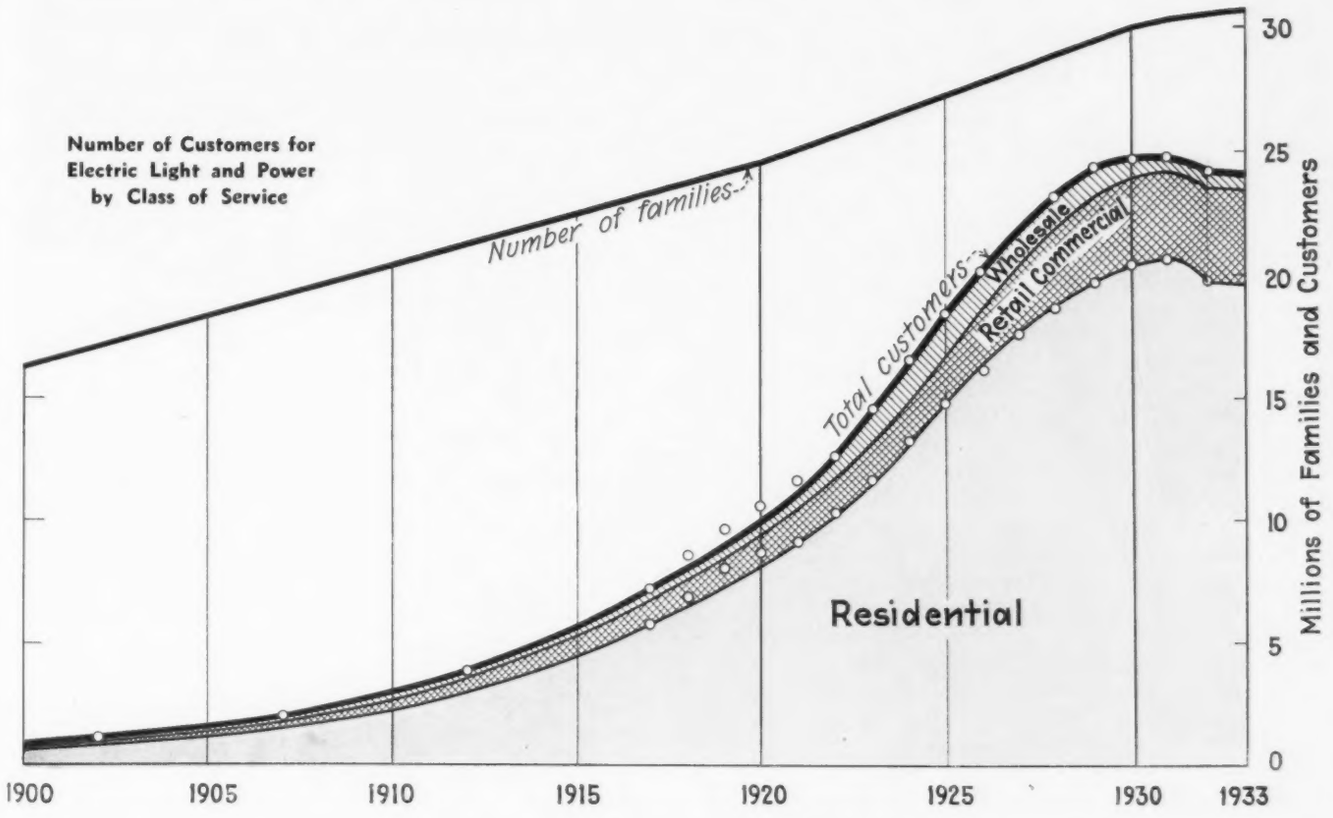
(Thousands of Dollars)

Year	Eastern	Southern	No. Central	Western	Totals for U. S.
1926	$50,000	$40,044	$80,000	$40,132	**$210,176**
1927	122,785	86,320	103,334	49,878	**362,317**
1928	80,927	51,753	88,960	45,966	**267,606**
1929	122,401	73,457	109,444	56,029	**361,331**
1930	152,762	92,484	128,784	58,540	**432,570**
1931	106,650	74,813	116,090	50,329	**347,883**
1932	55,000	30,000	47,000	25,000	**157,000**
1933	.....	.....	.....	.....	**120,000**

CENTRAL-STATION CUSTOMERS

	Total Number				Domestic Service*				Commercial Lighting and Small Power				Wholesale Power and Miscellaneous			
	1931	1932	1933	Change in 1933	1931	1932	1933	Change in 1933	1931	1932	1933	Change in 1933	1931	1932	1933	Change in 1933
UNITED STATES	**24,489,770**	**24,149,300**	**24,126,926**	**−22,374**	**20,151,247**	**19,849,963**	**19,843,724**	**−6,239**	**3,724,013**	**3,687,636**	**3,689,204**	**+1,568**	**614,510**	**611,701**	**593,998**	**−17,703**
NEW ENGLAND	**2,212,630**	**2,194,756**	**2,189,308**	**−5,448**	**1,857,706**	**1,841,188**	**1,840,085**	**−1,103**	**312,044**	**309,777**	**306,203**	**−3,574**	**42,880**	**43,791**	**43,020**	**−771**
Maine	190,603	192,628	201,113	+8,485	153,782	155,849	163,354	+7,505	31,140	31,022	32,282	+1,260	5,681	5,757	5,477	−280
New Hampshire	121,575	119,746	121,758	+2,012	101,744	100,231	102,045	+1,814	16,043	15,782	15,925	+143	3,788	3,733	3,788	+55
Vermont	79,459	79,893	80,989	+1,096	65,444	65,652	66,536	+884	11,448	11,591	11,770	+179	2,567	2,650	2,683	+33
Massachusetts	1,165,282	1,165,760	1,146,020	−19,740	976,782	975,683	961,756	−13,927	170,191	170,810	165,573	−5,237	18,309	19,267	18,691	−576
Rhode Island	190,319	188,774	190,372	+1,598	162,456	160,875	162,226	+1,351	24,493	24,481	24,640	+159	3,370	3,418	3,506	+88
Connecticut	465,392	447,955	449,056	+1,101	397,498	382,898	384,168	+1,270	58,729	56,091	56,013	−78	9,165	8,966	8,875	−91
MIDDLE ATLANTIC	**7,039,298**	**7,032,459**	**7,073,641**	**+41,182**	**5,809,414**	**5,793,098**	**5,816,089**	**+22,991**	**1,104,090**	**1,119,026**	**1,152,709**	**+33,683**	**125,794**	**120,335**	**104,843**	**−15,492**
New York	3,793,254	3,824,309	3,844,501	+20,192	3,088,550	3,098,733	3,102,130	+3,397	668,921	690,862	705,393	+14,531	35,783	34,714	36,978	+2,264
New Jersey	1,172,332	1,167,396	1,192,373	+24,977	975,787	975,524	999,510	+23,986	154,103	152,622	155,220	+2,598	42,442	39,250	37,643	−1,607
Pennsylvania	2,073,712	2,040,754	2,036,767	−3,987	1,745,077	1,718,841	1,714,449	−4,392	281,066	275,542	292,096	+16,554	47,569	46,371	30,222	−16,149
E. N. CENTRAL	**5,811,553**	**5,645,214**	**5,631,351**	**−13,863**	**4,922,710**	**4,773,734**	**4,770,394**	**−3,340**	**816,554**	**795,874**	**786,512**	**−9,362**	**72,289**	**75,606**	**74,445**	**−1,161**
Ohio	1,504,131	1,488,328	1,487,780	−548	1,294,270	1,280,711	1,282,841	+2,130	189,082	187,393	185,232	−2,161	20,779	20,224	19,707	−517
Indiana	696,974	662,560	663,603	+1,043	590,156	559,659	561,303	+1,644	92,188	87,913	88,029	+116	14,630	14,988	14,271	−717
Illinois	1,883,870	1,817,642	1,794,560	−23,082	1,594,607	1,536,375	1,518,743	−17,632	271,501	258,566	253,059	−5,507	17,762	22,701	22,758	+57
Michigan	1,085,348	1,042,720	1,047,658	+4,938	914,833	879,776	886,490	+6,714	166,398	159,165	157,443	−1,722	4,117	3,779	3,725	−54
Wisconsin	641,230	633,964	637,750	+3,786	528,844	517,213	521,017	+3,804	97,385	102,837	102,749	−88	15,001	13,914	13,984	+70
W. N. CENTRAL	**2,341,677**	**2,325,171**	**2,322,370**	**−2,801**	**1,932,525**	**1,921,293**	**1,919,329**	**−1,964**	**361,097**	**358,474**	**357,348**	**−1,126**	**48,055**	**45,404**	**45,693**	**+289**
Minnesota	463,357	480,563	478,830	−1,733	378,124	395,215	392,959	−2,256	65,637	66,251	66,176	−75	19,596	19,097	19,695	+598
Iowa	467,172	450,841	451,029	+188	398,277	380,791	380,663	−128	64,302	65,514	65,842	+328	4,593	4,536	4,524	−12
Missouri	665,120	664,143	663,632	−511	551,455	551,940	552,513	+573	107,147	107,343	106,274	−1,069	6,518	4,860	4,845	−15
North Dakota	68,334	68,794	68,776	−18	48,779	49,908	49,751	−157	16,844	16,415	16,480	+65	2,711	2,471	2,545	+74
South Dakota	83,839	83,176	83,287	+111	64,422	63,954	64,066	+112	15,379	15,078	15,071	−7	4,038	4,144	4,150	+6
Nebraska	245,460	237,100	235,983	−1,117	203,066	195,922	195,436	−486	36,191	35,112	34,827	−285	6,203	6,066	5,720	−346
Kansas	348,395	340,554	340,833	+279	288,402	283,563	283,941	+378	55,597	52,761	52,678	−83	4,396	4,230	4,214	−16
SOUTH ATLANTIC	**1,805,667**	**1,779,566**	**1,768,560**	**−11,006**	**1,491,927**	**1,467,155**	**1,459,389**	**−7,766**	**289,633**	**287,750**	**283,802**	**−3,948**	**24,107**	**24,661**	**25,369**	**+708**
Delaware	48,737	48,636	49,821	+1,185	40,439	40,169	41,142	+973	7,773	7,928	8,075	+147	525	539	604	+65
Maryland	325,802	325,100	329,217	+4,117	284,945	283,862	288,094	+4,232	38,939	39,304	39,195	−109	1,918	1,934	1,928	−6
Dist. of Columbia	130,707	131,728	130,975	−753	114,562	114,750	113,973	−777	15,904	16,861	16,859	−2	241	117	143	+26
Virginia	262,960	266,457	265,364	−1,093	218,858	218,334	217,888	−446	39,156	43,035	42,277	−758	4,946	5,088	5,199	+111
West Virginia	191,328	188,827	189,845	+1,018	155,699	153,721	155,408	+1,687	32,403	31,715	30,996	−719	3,226	3,391	3,441	+50
North Carolina	262,779	260,267	262,984	+2,717	216,979	215,031	217,990	+2,959	40,747	39,671	39,504	−167	5,053	5,565	5,490	−75
South Carolina	110,476	108,413	108,772	+359	87,074	85,687	86,158	+471	21,558	20,895	20,798	−97	1,844	1,831	1,816	−15
Georgia	220,894	208,886	207,934	−952	173,153	163,435	162,069	−1,366	45,996	43,803	44,180	+377	1,745	1,648	1,685	+37
Florida	251,984	241,252	223,648	−17,604	200,218	192,166	176,667	−15,499	47,157	44,538	41,918	−2,620	4,609	4,548	5,063	+515
E. S. CENTRAL	**820,187**	**781,749**	**773,746**	**−8,003**	**654,175**	**624,379**	**619,900**	**−4,479**	**153,345**	**142,463**	**139,929**	**−2,534**	**12,667**	**14,907**	**13,917**	**−990**
Kentucky	281,961	275,488	273,845	−1,643	228,318	223,341	222,676	−665	47,932	43,443	42,604	−839	5,711	8,704	8,565	−139
Tennessee	256,646	243,144	236,931	−6,213	206,164	195,756	191,202	−4,554	47,235	44,816	43,324	−1,492	3,247	2,572	2,405	−167
Alabama	185,308	171,168	172,476	+1,308	148,304	136,738	138,358	+1,620	35,632	32,817	33,091	+274	1,374	1,613	1,027	−586
Mississippi	96,272	91,949	90,494	−1,455	71,389	68,544	67,664	−880	22,548	21,387	20,910	−477	2,335	2,018	1,920	−98
W. S. CENTRAL	**1,296,342**	**1,245,161**	**1,240,388**	**−4,773**	**1,007,527**	**964,239**	**963,035**	**−1,204**	**240,956**	**230,771**	**227,931**	**−2,840**	**47,859**	**50,151**	**49,422**	**−729**
Arkansas	123,632	118,307	116,444	−1,863	92,529	88,613	87,068	−1,545	25,316	24,348	24,026	−322	5,787	5,346	5,350	+4
Louisiana	207,183	197,990	197,135	−855	169,103	160,322	159,625	−697	33,166	32,281	32,222	−59	4,914	5,387	5,288	−99
Oklahoma	281,952	268,114	265,604	−2,510	215,191	203,307	201,606	−1,701	48,308	47,205	46,568	−637	18,453	17,602	17,430	−172
Texas	683,575	660,750	661,205	+455	530,704	511,997	514,736	+2,739	134,166	126,937	125,115	−1,822	18,705	21,816	21,354	−462
MOUNTAIN	**633,789**	**628,829**	**624,945**	**−3,884**	**484,322**	**479,034**	**475,396**	**−3,638**	**92,017**	**92,331**	**91,007**	**−1,324**	**57,450**	**57,464**	**58,542**	**+1,078**
Montana	84,147	85,798	83,531	−2,267	66,410	66,952	65,611	−1,341	14,527	15,348	14,347	−1,001	3,210	3,498	3,573	+75
Idaho	75,713	76,898	76,658	−240	51,377	52,131	51,982	−149	11,358	11,715	11,516	−199	12,978	13,052	13,160	+108
Wyoming	33,642	32,717	32,423	−294	26,267	25,612	25,367	−245	6,059	5,863	5,810	−53	1,316	1,242	1,246	+4
Colorado	207,866	204,828	204,661	−167	164,225	161,543	161,426	−117	28,986	28,942	28,695	−247	14,655	14,343	14,540	+197
New Mexico	35,256	34,244	34,210	−34	26,773	25,946	25,952	+6	6,415	6,250	6,208	−42	2,068	2,048	2,050	+2
Arizona	71,673	69,256	67,722	−1,534	55,016	52,694	51,006	−1,688	10,098	9,801	9,735	−66	6,559	6,761	6,981	+220
Utah	107,776	107,721	107,625	−96	80,712	80,878	80,158	−720	11,439	11,315	11,491	+176	15,625	15,528	15,976	+448
Nevada	17,716	17,367	18,115	+748	13,542	13,278	13,894	+616	3,135	3,097	3,205	+108	1,039	992	1,016	+24
PACIFIC	**2,528,627**	**2,516,395**	**2,502,617**	**−13,778**	**1,990,941**	**1,985,843**	**1,980,107**	**−5,736**	**354,277**	**351,170**	**343,763**	**−7,407**	**183,409**	**179,382**	**178,747**	**−635**
Washington	425,783	416,805	414,431	−2,374	324,062	320,405	319,919	−486	61,267	55,858	53,871	−1,987	40,454	40,542	40,641	+99
Oregon	233,447	234,059	233,378	−681	179,082	180,778	180,342	−436	34,603	33,681	33,264	−417	19,762	19,600	19,772	+172
California	1,869,397	1,865,531	1,854,808	−10,723	1,487,797	1,484,660	1,479,846	−4,814	258,407	261,631	256,628	−5,003	123,193	119,240	118,334	−906

*For allocation of farm customers see text.



Utility Customers Returning

AT THE beginning of the year the number of customers had decreased 340,000 from the number at the beginning of 1932. The loss continued until June. Then the turn came, and by the end of the year most of it had been made up, bringing the total number to 24,127,000, of whom nearly 19,844,000 were domestic consumers. This group suffered a net loss for the year of 6,000. The recovery from the lowest month, May, was fully 200,000 and the upward trend appears to have been definitely re-established.

That the rate of increase can never again approach that of the middle twenties has long been evident. Instead of millions it can at best be counted in hundreds of thousands. Additional energy sales must henceforth come by expanding the consumption of individual users rather than by adding new ones. The country's urban communities are virtually saturated, as to numbers.

The greatest decrease occurred in the group of wholesale customers, who now number 594,000. Small commercial customers were the only class to show so much as a nominal gain. Some of the changes appearing in the table of customers by states are clearly due simply to reclassifications by the reporting companies, for example, the gain in retail and loss in wholesale commercial customers in Pennsylvania, which virtually balance.

These state figures indicate peculiar local differences—substantial gains in the Middle Atlantic states and in New England with the exception of Massachusetts, against losses in Massachusetts, Illinois, Florida and California.

In the statistics by states this class of service has in general been included in the number of domestic customers. But in certain parts of the country much of the energy sold to farm customers is used for irrigation, therefore those in the Southwest and far West have been included with wholesale power.

Growth in Farm Electrification

(Figures on Electrified Farms Do Not Include Those with Individual Lighting Plants)

Year	Total Number of Farms	Electrified Farms (Dec. 31)	Per Cent of Total
1900	5,737,372		
1910	6,361,502	(Data Not	
1920	6,448,343	Available)	
1921	.....		
1922	.....		
1923	.....	177,561	2.8
1924	.....	204,780	3.2
1925	6,371,640	246,150	3.9
1926	.....	309,125	4.9
1927	.....	393,221	6.2
1928	.....	506,242	8.0
1929	.....	576,168	9.2
1930	6,288,648	649,919	10.4
1931	.....	698,786	11.1
1932	.....	705,075	11.2
1933	.....	710,299	11.3

Number of Farm Service Customers

(As of December 31)

Region	1933	1932	1931	1930
United States	**710,299**	**705,075**	**698,786**	**649,919**
New England	54,495	52,923	52,237	48,996
Middle Atlantic	107,901	106,759	104,911	96,342
East North Central	173,147	170,421	166,893	151,113
West North Central	89,428	89,652	89,717	82,283
South Atlantic	49,321	49,080	47,958	42,539
East South Central	31,779	31,947	31,513	29,949
West South Central	22,420	22,653	22,170	21,438
Mountain	45,907	45,026	44,308	42,536
Pacific	135,901	136,614	139,079	134,723

346,350 Kw. Added in 1933

AT THE beginning of 1933 a number of power installations were under construction. The completion of many of these and of others started later brought a total of 346,350 kw. into operation. Of this, 251,025 kw. was in fuel-burning plants, divided into 148,875 kw. of additions to existing plants and 102,150 kw. in new ones. This includes 10,000 kw. in Hawaii. Water power constituted 95,325 kw., of which 30,800 kw. was in additions and 64,525 kw. in new plants.

Federal projects under construction are to call ultimately for 2,550,000 kw. More immediately, work undertaken by power companies and municipalities totals 821,450 kw. Some of this has been suspended; 169,450 is scheduled for 1934.

Federal loans granted to municipalities for light and power plants already amount to $99,311,400. The total of applications here listed is $47,520,211.

Grants of Government Aid

to Municipalities and Other Public Agencies

Municipality or Project	Amount
Lawler, Iowa	$1,400
Sheffield, Ala.	230,000
Tuscumbia, Ala.	130,000
Thief River Falls, Minn.	15,000
Chanute, Kan.	25,000
Loup River, Neb.	7,300,000
Culpeper, Va.	170,000
Fort Collins, Col.	738,000
Springfield, Ill.	78,000
Chambersburg, Pa.	24,000
Danville, Va.	3,000,000
Red Bluff, N. M.	2,600,000
Verde, Ariz.	4,000,000
North Platte, Neb.	7,500,000
Tennessee Valley Authority	50,000,000
Bonneville Dam	22,500,000
Grand Coulee Development	1,000,000

Applications for Government Aid

Filed by Municipalities

Municipality	Amount
Fredericktown, Mo.	$132,525
Owensville, Mo.	89,000
Trenton, Mo.	315,100
Licking, Mo.	72,858
Monett, Mo.	148,505
Covington, Va.	350,000
Carbondale, Ill.	425,000
St. Charles, Mo.	350,000
Moberly, Mo.	700,000
Cape Girardeau, Mo.	685,223
Onawa, Ohio	50,000
Paragould, Ark.	175,000
Tarrytown, N. Y.	150,000
Jamestown, N. D.	600,000
Centralia, Mo.	60,000
Denison, Tex.	35,000,000
Gillette, Wyo.	8,217,000

Power Plant Capacity Added During 1933

STEAM-ELECTRIC PLANTS

Company, Station and Location	Added to Existing Plants, Kw.	New Plants, Kw.
Braintree, Mass., municipal plant	3,500	.....
Taunton, Mass., municipal plant	7,500	.....
Bath, N. Y., municipal plant	(a) *800	.....
General Electric Co. (leased to and operated by N. Y. P. & L. Corp.) Schenectady	.....	†20,000
	.....	6,000
Public Service Elec. & Gas Co., Burlington, N. J.	(a) 18,000	.....
Public Service Electric & Gas Co., Kearny, N. J.	†20,000	.....
Potomac Electric Power Co., Buzzards Point	.....	35,000
Bryan, Ohio, municipal plant	*1,000	.....
Piqua, Ohio, municipal plant	.....	8,000
Richmond, Ind., municipal plant	15,000	.....
Peru, Ind., municipal plant	5,000	.....
Chicago, Ill., municipal plant	.....	1,500
Geneseo, Ill., municipal plant	.....	*750
Salem, Ill., municipal plant	625	.....
Detroit Edison Co., Delray No. 3	50,000	.....
Wyandotte, Mich., municipal plant	.....	2,400
Sioux Falls, S. D., municipal plant	*750	.....
Austin, Texas, municipal plant	7,500	.....
Greenville, Tex., municipal plant	(a) *1,700	.....
Lubbock, Tex., municipal plant	*1,000	.....
Colorado Springs, Colo., municipal plant	5,000	.....
Vernon, Calif., municipal plant	.....	*30,000
Hawaiian Electric Co., Hawaii	10,000	.....

HYDRO-ELECTRIC PLANTS

Safe Harbor Water Power Corp., Safe Harbor	28,000	.....
U. S. Gov't. Lock & Dam No. 15, Mississippi R.	.....	250
U. S. Bureau of Reclam., Grand Valley, Palisade, Colo. (b)	.....	3,000
Puget Sound Pwr. & Lt. Co., Rock Island, Wash	.....	60,000
Sierra Pacific Power Co., Farad Plant, Calif.	(a) 2,800	.....
U. S. Indian Irrig. Service, Drop. No. 3, Yakima River	.....	1,275

Capacity Scheduled for Completion in 1934 or Later

STEAM-ELECTRIC PLANTS

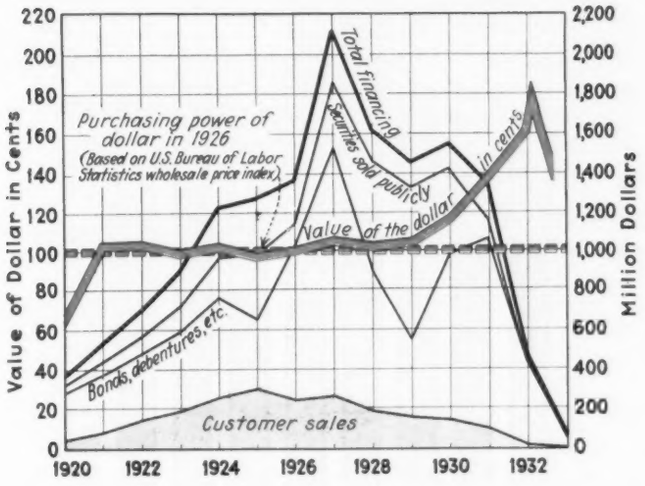
Company, Station and Location	Added, Kw.	New, Kw.
Holyoke, Mass., municipal plant	5,000	.....
Philadelphia Electric Co., Richmond (e)	165,000	.....
Oberlin, Ohio, municipal plant	.....	*1,600
Carlyle, Ill., municipal plant	500	.....
Chicago District Elec. Gen. Corp., State Line (e)	275,000	.....
Milwaukee Elec. Ry. & Lt., Port Washington (e)	.....	80,000
Alexandria, Minn., municipal plant	1,500	.....
Blue Earth, Minn., municipal plant	500	.....
Thief River Falls, Minn., municipal plant	*700	.....
Kennett, Mo., municipal plant	.....	*700
Culpeper, Va., municipal plant	.....	*700
Plainview, Texas, municipal plant	.....	*1,500

HYDRO-ELECTRIC PLANTS

Bangor Hydro-Electric Co., Veazie, Me.	(a) 700	.....
Lyman Falls Power Co., North Stratford, N. H.	(a) 1,200	.....
Lamoka Power Corp., Keuka, N. Y.	5,000	.....
Safe Harbor Water Power Corp., Safe Harbor	28,000	.....
Radford, Va., municipal plant	.....	800
Allegan, Mich., municipal plant, Kalamazoo R.	.....	2,000
Central Texas Hydro-Elec., Hamilton Dam (e)	.....	20,000
Sequin, Texas, municipal plant	250	.....
Rocky Mountain Power Co., Flathead, Mont. (e)	.....	112,000
Seattle, Wash., Dept. of Ltg., Diablo	.....	118,800
Tennessee Valley Authority, Norris Dam, Cove Creek (year indefinite)	.....	165,000
U. S. Bureau of Reclam., Boulder Canyon (c) (1937)	.....	1,400,000
Columbia Basin Comm., Grand Coulee (1938)	.....	550,000
U. S. Corps. of Engineers, Bonneville Dam, Columbia River (1937)	.....	(d) 435,000

*Internal-combustion engine.
†Mercury-vapor turbine.
(a) Total or partial replacement or rehabilitation.
(b) Operated by Public Service Co. of Colorado.
(c) First unit—41,000 kw. (1935); four 82,500-kw. units to follow.
(d) Initial installation 90,000 kw.
(e) 1935 or later.

The Depression-Proof Industry



—Was the "myth" exploded too soon?
—Revenue says so.
—Earnings say so.
—General position says so.

BUT

—There is the story of the markets.
—Stocks and bonds are under discrimination.
—Maturities must be met.

It seems time to take advantage of a good position and make it better.

BEFORE the crash, in 1929 or thereabouts, one heard, perhaps even talked, much of the electric utilities as the depression-proof industry. Came 1931 and 1932 and fashions changed, the familiar designation was heard no more. Came 1933, it was hard to believe that such things had ever been said. Yet in retrospect that is just what the utilities have been—depression-proof industry.

Not that security values have not slumped to appalling depths (but that is essentially a matter of confidence), not that earnings have not been cut (that has been a matter of political pressure and responsive management), not that the future is not black with threats of government competition (that is appallingly serious), not that the cries of the utility-baiters are not heard (they are deafening). But the enterprise, as a whole, has done surprisingly well.

The story of the markets

Ever the final arbiter in security matters, the stock and bond markets have told the dismal tale of impaired investor confidence with sharp clarity. Even as in the past three months' broad rise in general shares the utilities have been laggard and neglected, so have they fallen to high yields and low prices in the wave of popular disfavor and distrust. Confidence must be restored and can be.

Some companies are maintaining their dividends at the old rates, but prices have slumped none the less wildly. A few leaders of this type may be illustrated:

	Market Price Late in 1929	1933
Consolidated Gas, Elec. Lt. & Pwr. (dividend increased)	83	46
Consolidated Gas (dividend increased)	111	38
Louisville Gas & Electric (dividend same)	41	16
National Power & Light (dividend same)	38	10
Pacific Lighting (dividend same)	85	24
Pennsylvania Water & Power (dividend increased)	73	47
Southern California Edison (dividend same)	61	16
United Gas Improvement (dividend increased)	190	15

Utility bonds have suffered correspondingly. In few instances indeed are interest payments impaired, but the average price has fallen from 100 to 83. Yields are correspondingly high and promise little in the encouragement of new financing or the financing of maturing obligations. Moody's Investors Service reported utility bonds to yield an average 6.75 per cent early in December, with a high in 1933 of 7.17 and a low of 5.47. A year ago this was 5.87 per cent. Two years ago the average early in December was 6.07. Current yields in other groups are: Railroad, 5.96, and industrials, 5.01.

Nevertheless, there are maturities of $158,000,000 to be met in 1934, against $161,000,000 in 1933. Maturities were $165,000,000 in 1932. This year the refunding was accomplished with practically no public offerings. The only important ones were:

Consolidated Gas, Elec. Light & Power	$5,000,000
Lake Erie Power & Light	475,000
Narragansett Electric	3,000,000
Ohio Edison	8,000,000
Union Electric Light & Power	11,250,000
Edison Elec. Ill. Co. of Boston	26,000,000
Total	$53,725,000

Defaults of 1933

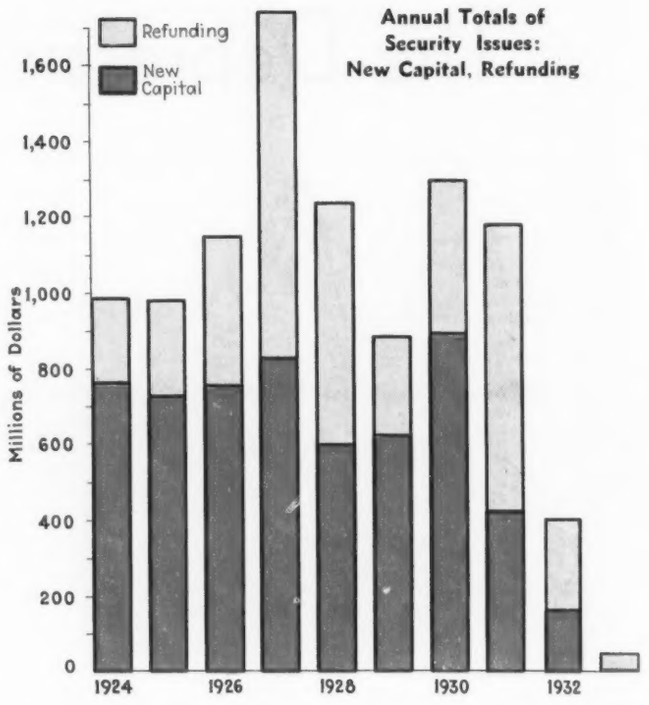
There were properties which were unable to maintain the pace set by industry leaders. Properties where complexities and pressure brought defaults of interest or principal of funded debt. Holding company defaults totaled $87,883,610. Operating company defaults were $8,044,400, a total of $95,928,010. New receiverships were few, mostly of Insull sub-properties.

It is time for utility management to make its stand for the right to continued existence, the right to future public and investor confidence, the right to investment preservation and the right to be looked upon as something more than the public menace that political critics portray.

To accomplish this it would appear that recognition of criticism which will correct the condition should be made. Who knows what that may be? Perhaps a new policy on rates, industrial versus domestic. Perhaps a new viewpoint toward the question of holding versus operating companies. Perhaps a shake-up that will surprise the nation. It will have to be something, and one suspects that it cannot be defense of the *status quo* and

Maturities of 1934

	Amount	
January 1, 1934		
Flambeau Power Company 1st ser. 6s A	$12,500	
Indiana Service Corporation eq. 6s E	8,000	
Mineral Point Public Service Co. 1st 6s	465,800	
Montana-Dakota Power Company 1st 5½s	8,500,000	
Northern New York Power Corp. 1st 6s	45,000	
Utah Light & Traction Co. 1st coll. 8s	1,401,000	
January 2		
Utah Light & Railway Co. cons. 5s	486,000	$10,918,300
February 1		
Elko Lamoille Pwr. Company 1st ser. 7s	5,000	
Florida Public Service Co. 10-year sec. 7s	550,000	
Fontana Power Company 1st ser. 6s	11,000	
Iowa Electric Light & Power Co. 7 per cent notes	375,000	
South Jersey Power & Light Co. 6 per cent notes	125,000	
February 15		
New England Power Association 5½ per cent sec. ser. notes	360,000	$1,426,000
March 1		
Colonial Utilities Corporation 6 per cent sec. notes	250,000	
March 14		
Staten Island Edison Corporation ref. & imp. 6s	500,000	$750,000
April 1		
American Water Works & Elec. Co., Inc., coll. 5s	12,569,100	
Montana-Dakota Utilities Co. joint gold 6s	4,500,000	
North American Light & Pwr. Co. 5 per cent notes	2,000,000	
North Carolina Public Service Co. 1st ref. 5s	1,663,200	
April 15		
American & Foreign Power Co. 7 per cent notes	35,000,000	$55,732,300
May 1		
Great Lakes Power Company 1st 6s	130,000	
May 14		
Staten Island Edison Corp. ref. & imp. 6s	500,000	$630,000
June 1		
Iowa Southern Utilities Co. 6 per cent notes	50,000	
Middle West Utilities Co. 5 per cent conv. notes	10,000,000	
Mutual Electric Company 1st 5s	94,000	
Weymouth Light & Power Co. 1st 5½s	240,000	$10,384,000
July 1		
Gary Electric & Gas Company 1st coll. 5s A	8,000,000	
Iowa Electric Company 1st 6s	1,166,300	
Iowa Gas & Electric Company 1st 6s	647,400	
Janesville Electric Company 1st 5s	10,000	
Los Angeles Gas & Electric Co. gen. 5s	848,000	
Michoacan Power Company 1st 6s	100,000	
United Gas & Electric Company 1st 5s	35,000	
Virginia Railway & Pwr. Co. 1st ref. 5s	10,633,000	
July 16		
Edison Elec. Ill. Co. of Boston 5 per cent notes	25,000,000	$46,439,700
August 1		
Iowa Electric Light & Power 7 per cent notes	375,000	
Pennsylvania Electric Company 6s	2,540,000	
Pennsylvania Electric Company 7½s	105,000	
August 15		
General Gas & Electric Corp. 5 per cent notes	830,000	$3,850,000
September 1		
Redlands Water & Power Co. 1st 5½s	2,000	
Rockland Light & Power Co. conv. 6s	16,000	
Western Massachusetts Cos. 4½ per cent notes	5,000,000	$5,018,000
October 1		
Androscoggin Electric Co. 1st ref. 5s	3,800,000	
Salt River Valley Water Users Assn. 5½s	60,000	$3,860,000
November 1		
Broad River Power Company sec. 6½s	1,042,300	
Citizens Light Heat & Pwr. Co. 1st 5s	965,000	
Nebraska Light & Power Company 1st 6s	300,000	
Northern Electric Co. & Northern Paper Mills 1st 5s	75,000	
November 15		
Arkansas Pass-Rockport Lt. Ice & Pwr. 1st 6s	16,000	$2,398,300
December 1		
Berkshire Power Company 1st 5s	58,000	
Elmira Water, Light & R.R. Co. 5½ per cent notes	2,277,700	
Minneapolis General Electric Co. 1st 5s	6,488,900	
Texas Power Corporation 7 per cent notes	64,000	
December 2		
Central Public Service 1 per cent = 5 per cent notes	7,465,809	
Suburban Gas & Elec. 2-year 4½ per cent notes	375,000	$16,728,509
		$158,135,109



of the prejudices, enmities and unpopularity which that engendered.

Depreciation policies change

Notable departure from 1929 practices in relation to depreciation accounting appears in the most recent figures. In 1929 the average charge to depreciation against gross revenue was 7.8 per cent. In the recent (1932) figures it is 8.9 per cent. Some organizations, such as Cleveland Electric Illuminating Company (15.8 per cent in 1933; 12 per cent in 1929), have been higher than the

Financing Virtually at Standstill

	Public Sales	Customer Sales	Total Sales
1920	$326,374,000	$43,000,000	$369,374,000
1921	458,917,000	80,000,000	538,917,000
1922	589,961,000	130,000,000	719,961,000
1923	747,722,000	175,000,000	922,722,000
1924	982,421,000	254,000,000	1,236,421,000
1925	982,223,000	297,561,000	1,279,784,000
1926	1,150,965,000	236,557,100	1,387,522,100
1927	1,888,909,000*	263,527,000	2,152,436,000
1928	1,471,497,000*	181,682,041	1,653,179,000
1929	1,328,708,000*	153,436,000	1,482,144,000
1930	1,452,853,000*	139,132,000†	1,591,985,000
1931	1,341,742,000*	150,000,000†	1,491,742,000
1932	447,920,608*	18,000,000†	465,920,608
1933	55,872,778*	375,000†	56,247,778

* Including Rights. † Approximately

Security Issues of 1933 Half Bonds, Half Notes

	Amount of Issue
Mortgage bonds (average yield 4.78%)	
5 issues yielding from 4.12 to 6.35%	$27,725,000
Notes	
1 issue yielding 5.36%	16,000,000
1 issue yielding 3.50%	10,000,000
Rights	2,147,778
Total public sales	55,872,778
Estimated local sales to customers	375,000
All financing	56,247,778

average at both dates. Southern California Edison has likewise maintained a relatively high rate. Others, such as New York Edison, Georgia Power, Montana Power and Texas Power & Light, have averaged around 5 per cent.

In 1929 the average gross revenue per dollar of total corporate assets for 24 representative American light and power enterprises (seven management holding companies, three investment holding companies, seven metropolitan operating companies and seven widespread operating companies) was 14.7 cents. In the most recent figures available that same value became 11.3 cents, a decline of 23.2 per cent. On the basis of gross revenue per dollar of capitalization the value went from 18.9 cents to 14.0 cents, a decline of 26 per cent. Certainly about as good a record as any large American industry can show.

Receiverships of 1933

	Receiver Appointed
Central Gas & Electric Co.	January 27
Columbus, Delaware & Marion Electric Co.	January 6
Commonwealth Light & Power Co. (Insull)	January
Northeastern Public Service Co. (Insull)	January
Continental Shares, Inc.	June
Arkansas-Missouri Power Co. (Insull)	November
Central West Public Service Co.	December

Four Years With Utility Common Stocks

	Dividend ($)		Market 1933 Dec. 5	Price 1929 Dec. 31
	1933	1929		
American & Foreign Power	—	—	10	99
American Commonwealths Power, A	—	0.15 + 2.5% stk.	—	25
American Gas & Electric	1.00 + 4% stk.	1.00 + 54% stk.	21	114
American Light & Traction*	1.90	10.00	11	228
American Power & Light	—	1.00	7	89
American States Public Service, A	—	1.48	⅝	19
American Superpower, A	—	—	3	25
American Waterworks & Electric	1.00	1.00 + 15% stk.	18	98
Associated Gas & Electric, A	—	2.40	⅜	37
Cities Service	—	0.30	2	27
Cleveland Electric Illuminating	1.50	2.05	23	63
Columbia Gas & Electric	0.775	2.00	12	85
Commonwealth & Southern	—	2.5% stk.	2	16
Commonwealth Edison	4.50	8.00	38	242
Consolidated Gas, Elec. Lt. & Pwr. of Baltimore	3.60	3.00	46	83
Consolidated Gas of New York	3.45	3.25	38	111
Detroit Edison	4.50	8.00	60	218
Duke Power	4.25	5.75	41	149
Eastern States Power, B	—	—	1	20
Edison Electric Ill. of Boston	10.50	12.40	124	242
Electric Bond & Share†	1.5% stk	4.5% stk.	15	83
Electric Power & Light	—	2.00	6	61
Engineers Public Service	—	1.00	4	48
Federal Light & Traction	—	1.325 + 4% stk.	7	68
Long Island Lighting	—	0.55	4	43
Louisville Gas & Electric, A	1.75	1.75	16	41
National Power & Light	1.00	1.00	10	38
Niagara Hudson Power†	—	0.20	6	12
North American	8.5% stk.	10% stk.	16	103
Northern States Power, A	4.50	8.00	21	185
Pacific Gas & Electric	1.875	2.00	18	56
Pacific Lighting	3.00	3.00	24	85
Pennsylvania Water & Power	3.00	2.50	47	73
Public Service of No. Ill.	2.50	8.00	16	227
Public Service of New Jersey	2.90	2.60	35	91
Southern California Edison	2.00	2.00	16	61
Standard Gas & Electric	—	3.50	9	110
Standard Power & Light	—	—	4	125
Tampa Electric	2.24	2.00 + 4% stk.	24	54
United Corporation‡	0.30	—	5	37
United Gas Improvement	1.20	1.17	15	190
United Light & Power, A	—	0.54	3	30

*Stock split 4 to 1 between 1929 and 1933.
†Stock grouped 1 for 3 between 1929 and 1933.
‡Stock split 5 to 1 between 1929 and 1933.

With Utility Bonds Over Four Years

	Interest Rate	Maturity Date	Market 1933*	Price 1929*
American Power & Light	6	2016	44	106
American Water Works & Electric	5	1934	92	101
American Water Works & Electric	6	1975	62	105
Brooklyn Edison (Series A)	5	1949	104	105
Connecticut Railway & Lighting	4½	1951	95	96
Consolidated Gas of New York	5½	1945	101	106
Consumers Power	5	1952	101	104
Detroit Edison	5	1955	93	103
Detroit Edison	5	1949	96	103
Federal Light & Traction	6	1942	63	103
Federal Light & Traction	6	1954	48	94
Federal Light & Traction	5	1942	63	96
Florida Power & Light	5	1954	50	83
Illinois Power & Light	5½	1954	48	100
Long Island Lighting	6	1945	72	104
Louisville Gas & Electric	5	1952	87	102
Milwaukee Electric Ry. & Lt. (Series B)	5	1961	65	100
Montana Power (Series A)	5	1943	78	103
New Orleans Public Service (Series A)	5	1952	45	86
New York Edison (Series A)	6½	1941	109	114
New York Edison	5	1944	104	104
Northern States Power (Series B)	6	1941	94	106
Northern States Power	5	1941	91	102
Ohio Power	5	1952	90	101
Ohio Public Service (Series A)	7½	1946	83	112
Pacific Gas & Electric	5	1942	102	103
Ohio Public Service	7	1947	91	111
Penn Ohio Edison	6	1950	48	101
Portland General Electric	5	1935	80	103
Rochester Gas & Electric	5½	1948	99	105
San Antonio Public Service	6	1952	76	106
Sierra & San Francisco Power	5	1949	90	99
Southern California Edison	5	1951	95	100
Southern California Edison	5	1954	95	101
St. Joseph Ry., Lt., Ht. & Pwr.	5	1937	76	97
Tennessee Electric Power	6	1947	57	106
Union Electric Light & Power (Ill.) (Series A)	5½	1954	100	103
Utah Power & Light	5	1944	59	100
Utica Gas & Electric	5	1957	106	104
West Penn Power (Series A)	5	1946	103	104

*Year end.

Defaults of 1933

	Holding Companies	Defaulted
$10,000,000	Central Gas & Electric 3-year 5½s 1933	February
35,533,500	Central Public Service conv. 5½s	February
1,732,000	Central States Edison 1st 5½s	April
1,664,210	Commonwealth Light & Power ref. 7s	January
1,170,000	East Coast Utilities 1st 5½s	August
2,593,000	Electric Public Service secured B 6s	February
651,900	Inland Power & Light coll. A 6s	March
1,326,000	Inland Power & Light coll. B 6s	May
2,794,000	Inland Power & Light coll. C 6s	April
11,680,000	Northeastern Public Service gen. 5½s	January
4,339,000	Rochester Central Power deb. 5s	September
12,600,000	Texas Louisiana Power 1st A 6s	January
1,800,000	Texas Louisiana Power first B 5½s	March
$87,883,610		

	Operating Companies	
346,000	Arizona Power 1st 5s 1933	May
2,407,500	Arizona Power unifying 6s	May
1,405,000	Burlington Railway & Light 8s	October
545,900	Florida Public Service 1st A 6½s	August
3,340,000	Florida Public Service 1st B 6s	April
8,044,400		
$95,928,010	Total	

Net earnings —that is, the amount available for dividends on common stock after all other charges were provided for, showed, per dollar of total corporate assets, 4 cents in 1929 and 2 cents in the latest available figures, a decline of 50 per cent. Net earnings per dollar of capitalization was 5 cents in 1929, 2.5 cents in the most recent figures, a decline of 53 per cent. Relatively few companies have ceased to pay common dividends, few have slashed preferred stock disbursements and defaults on senior securities are almost negligible in relationship to the size of the industry.

One concludes that the credit of the industry should be excellent; one recognizes that public confidence, because of less tangible factors, is appallingly low. New financing and refinancing must and will be done in the future; it is up to utility men to regain confidence in themselves and their works and to foster public confidence by favorable action under fire, and surely there has been and will be plenty of fire.

Metropolitan operating companies have fared best in the difficult days, widespread operating organizations have been next and then management and investment properties followed in the order named, as the table shows.

Company Groups	Average Change Between 1929 and 1933: Gross Revenue per Dollar of Total Assets	Gross Revenue per Dollar of Capitalization	Net Earnings per Dollar of Total Assets	Net Earnings per Dollar of Capitalization
	Per Cent			
Metropolitan	— 18.0	— 21.5	— 27.5	— 29.2
Widespread	— 25.0	— 25.8	— 58.5	— 57.5
Management	— 20.0	— 22.0	— 66.0	— 61.0
Investment	— 60.0	— 58.0	— 74.0	— 80.0
All	— 23.2	— 26.0	— 50.0	— 53.0

As shown in figures and charts in greater detail in accompanying illustrations the variations within each group of companies have been wide, some have weathered the storm better than others, some have maintained an unusually successful position well. It should be kept in mind that because of the unavailability of 1933 figures for certain companies 1932 figures were used as indicated.

So divergent are the figures for metropolitan operating and investment holding companies that in the case of gross revenues per dollar of assets virtually every metropolitan enterprise at its worst was better than the average for the whole 24 companies at their best (1929 average). Also, no investment company at its best succeeded in doing as well as the worst (1933 average) for the entire group.

Four Classifications of Utilities Show Wide Revenue Variations in Four Years

Management Holding Company Group
(Consolidated Balance Sheet Including Subsidiaries)

1. Commonwealth & Southern†
2. Consolidated Gas†
3. Engineers Public Service†
4. North American
5. Niagara Hudson†
6. Standard Gas & Electric‡
7. United Gas Improvement†
8. Average

Investment Holding Company Group

9. Electric Bond & Share†
10. Electric Power & Light
11. National Power & Light
12. Average

Metropolitan Operating Company Group

13. Cleveland Electric Illuminating†
14. Commonwealth Edison
15. Consolidated Gas, Electric Light & Power*†
16. Duquesne Light†
17. Edison Electric Illuminating of Boston‡
18. New York Edison†
19. Philadelphia Electric‡
20. Average

Widespread Operating Company Group

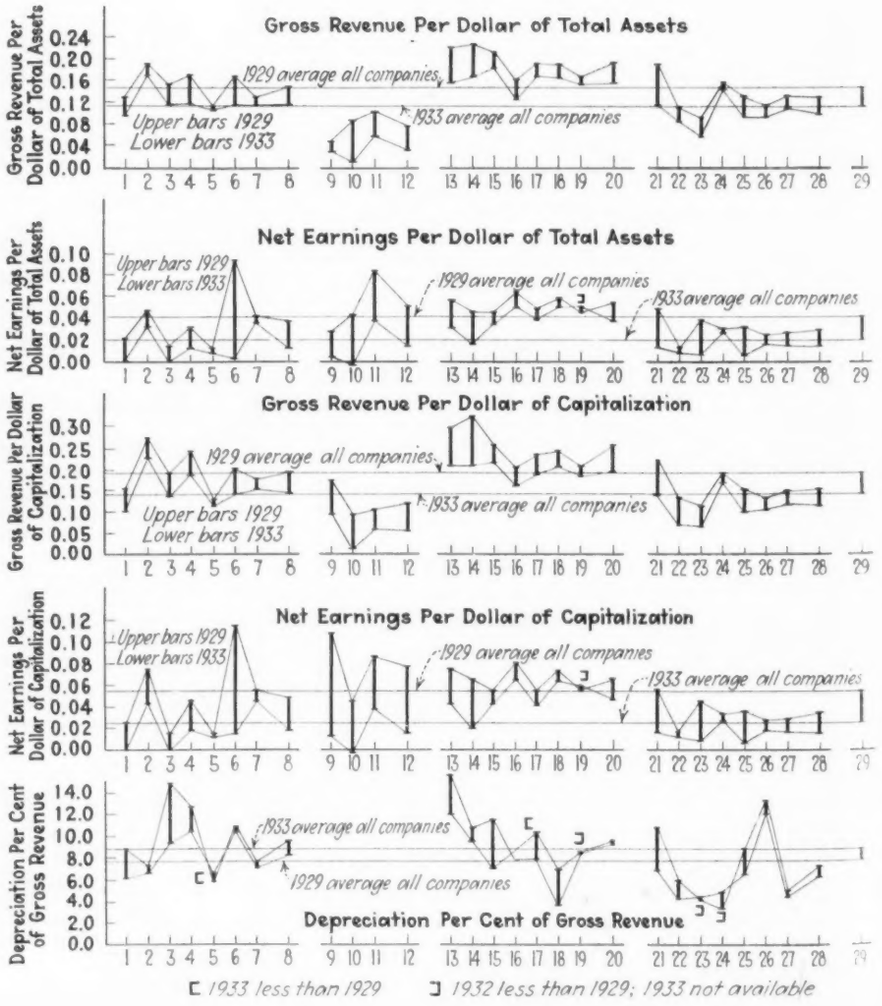
21. Consumers Power†
22. Georgia Power†
23. Montana Power‡
24. Pennsylvania Power & Light‡
25. Puget Sound Power & Light
26. Southern California Edison†
27. Texas Power & Light‡
28. Average
29. Average for all companies

Unless otherwise noted Balance Sheet and Income Account date for 1929 are for year ended December 31; 1933 figures are for twelve months ended September 30.

†Balance sheet data not available for 1933; 1932 figures used with 1933 income data.

‡1933 figures not available; 1932 figures used.

*Adjusted for twelve months on the basis of nine months data for 1933.


Gross Revenue Per Dollar of Total Assets
Gross Revenue Per Dollar of Total Assets
1929 average all companies
1933 average all companies
Upper bars 1929
Lower bars 1933
Net Earnings Per Dollar of Total Assets
Net Earnings Per Dollar of Total Assets
Gross Revenue Per Dollar of Capitalization
Gross Revenue Per Dollar of Capitalization
Net Earnings Per Dollar of Capitalization
Net Earnings Per Dollar of Capitalization
Depreciation Per Cent of Gross Revenue
Depreciation Per Cent of Gross Revenue
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
⊏ 1933 less than 1929
⊐ 1932 less than 1929; 1933 not available

1929-1933 Revenues of 24 Electric Utilities

(See chart on preceding page also)

Management Holding Companies Consolidated Balance Sheet (including subsidiaries)	Gross Revenue per Dollar of Total Assets			Net Earnings per Dollar of Total Assets			Gross Revenue per Dollar of Capitalization			Net Earnings per Dollar of Capitalization			Earned per Share of Common ($)			Paid Dividend per Share of Common ($)			Depreciation per Dollar of Gross Revenue		
	1929	1933	% Chge.	1929	1933	% Chge.	1929	1933	% Chge.	1929	1933	% Chge.	1929	1933	% Chge.	1929	1933	% Chge.	1929	1933	% Chge.
Commonwealth & Southern*	0.130	0.096	-26.2	0.021	0.000	-100	0.150	0.105	-30.0	0.025	0.000	-100	0.70	0.01	-98	——	——	——	0.061	0.087	-29.9
Consolidated Gas*	0.190	0.167	-12.1	0.046	0.031	-32.5	0.270	0.225	-16.6	0.076	0.042	-44.7	4.75	3.65	-23	4.00	3.60	-10	0.066	0.071	7.6
Engineers Public Service*	0.153	0.118	22.9	0.013	0.000	-100	0.181	0.133	-26.5	0.016	0.000	-100	2.38	0.07	-97	2.40	——	-100	0.095	0.149	-57.0
North American	0.167	0.119	-28.8	0.030	0.012	-60.0	0.240	0.181	-24.5	0.042	0.019	-54.5	5.03	1.43	-71	10%"	8½%"	-15	0.105	0.126	-19.9
Niagara Hudson*	0.110	0.104	-5.4	0.011	0.009	-18.2	0.125	0.118	-5.6	0.013	0.011	-15.4	0.61†	0.72	+8	0.40	——	-100	0.063	0.059	-6.3
Standard Gas & Elec ‡	0.165	0.114	-30.9	0.094	0.001	-99.0	0.200	0.135	-32.5	0.115	0.013	-89	6.59	0.59	-91	3.50	——	-100	0.105	0.106	-0.9
United Gas Improvement*	0.130	0.116	-10.8	0.040	0.035	-12.5	0.175	0.152	-13.1	0.054	0.046	-14.8	1.55	1.28	-18	1.20	1.20	0.0	0.071	0.074	-4.2
Average	0.149	0.119		0.036	0.012		0.191	0.149		0.049	0.019		3.09	1.10					0.081	0.096	
Investment Holding Companies																					
Electric Bond & Share*§	0.045	0.027	-39.9	0.028	0.003	-89.2	0.170	0.087	-48.7	0.107	0.012	-88.7	2.22§	0.41	-82	3%"	1½%"	-50	——	——	——
Electric Power & Light	0.084	0.008	-90.3	0.041	0.002	-105	0.089	0.009	-90.0	0.043	0.002	-104	2.98	0.116	-104	1.00	——	-100	——	——	——
National Power & Light	0.100	0.056	-44.0	0.082	0.036	-56.1	0.107	0.059	-44.8	0.088	0.038	-56.7	2.17	1.05	-52	1.00	1.00	0.0	——	0.130	——
Average	0.076	0.030		0.050	0.013		0.122	0.051		0.079	0.016		2.45	0.52							
Metropolitan Operating Companies																					
Cleveland Elec. Ill. Co.*	0.220	0.153	-30.5	0.057	0.030	-47.4	0.296	0.209	-29.4	0.076	0.041	-46.0	4.26	1.71	-60	1.60	1.50	-6.6	0.120	0.158	-31.7
Commonwealth Edison	0.223	0.164	-26.4	0.044	0.016	-63.5	0.321	0.208	-35.2	0.063	0.020	-68.3	12.05	4.40	-63	8.00	4.50	-43	0.097	0.107	-10.3
Consol. Gas, Elec. Lgt. & Power¶*	0.218	0.181	-13.8	0.042	0.034	-19.1	0.268	0.222	-17.4	0.054	0.041	-24.1	6.44	4.44	-31	3.60	3.60	-0.0	0.070	0.113	-61.3
Duquesne Light*	0.160	0.123	-23.1	0.062	0.048	-22.6	0.206	0.161	-21.8	0.080	0.063	-21.2	5.75	4.50	-21	4.00	——	——	——	0.077	——
Edison Elec. Ill. Co., Boston‡	0.190	0.168	-11.5	0.047	0.036	-23.3	0.230	0.185	-19.5	0.056	0.040	-28.5	13.58	12.40	-9.7	13.60	10.50	-23	0.111	0.078	-29.7
New York Edison*	0.187	0.162	-13.3	0.058	0.049	-15.5	0.247	0.206	-16.6	0.072	0.063	-12.5	6.07	4.75	-22	5.00	——	——	0.071	0.035	-50.7
Philadelphia Elec. Co.‡	0.164	0.152	-7.3	0.045	0.047	-4.4	0.206	0.184	-10.7	0.056	0.257	-1.7	1.87	1.89	+1	2.60	1.80	-30	0.084	0.083	-1.1
Average	0.193	0.158		0.051	0.037		0.253	0.196		0.065	0.046		7.14	4.87					0.092	0.093	
Widespread Operating Companies																					
Consumers Power Co.*	0.187	0.118	-36.9	0.047	0.016	-74.5	0.222	0.136	-38.7	0.055	0.014	-74.5	5.21	1.75	-66	4.70	——	——	0.069	0.106	-53.5
Georgia Power Co.	0.109	0.082	-24.8	0.012	0.009	-25.0	0.123	0.090	-26.8	0.013	0.012	-7.7	1.19	1.00	-16	0.00	——	——	0.042	0.059	-40.5
Montana Power Co‡	0.092	0.055	-40.2	0.037	0.005	-86.5	0.12	0.069	-38.4	0.045	0.007	-84.5	1.87	0.32	-30	1.00	0.25	-75	0.043	0.041	-4.6
Pennsylvania P. & L.‡	0.155	0.145	-6.5	0.027	0.025	-7.4	0.182	0.166	-8.8	0.032	0.029	-9.3	3.69	3.20	-13	——	——	——	0.049	0.032	-34.8
Puget Sound P. & L.	0.129	0.087	-32.6	0.030	0.005	-83.2	0.150	0.100	-33.3	0.035	0.005	-85.5	1.98	0.58	-70	4.00	0.00	-10	0.065	0.089	-37.0
So. Calif. Edison Co.*	0.112	0.092	-17.8	0.024	0.017	-29.2	0.127	0.106	-16.5	0.027	0.019	-29.6	3.44	2.12	-38	2.00	2.00	-0.0	0.120	0.131	-9.2
Texas Power & Light‡	0.132	0.107	-18.9	0.026	0.014	-46.2	0.145	0.117	-19.3	0.028	0.015	-46.4	0.48	0.30	-37	None	——	——	0.045	0.049	-8.9
Average	0.131	0.098		0.029	0.012		0.151	0.112		0.033	0.014		2.55	1.32					0.062	0.072	
Grand Average	0.147	0.113	-23.2	0.040	0.020	-50	0.189	0.140	-26	0.053	0.025	-53							0.078	0.089	-14.1

Unless otherwise noted 1929 figures are for year ended December 31; 1933 figures are for twelve months ended September 30.
* Balance sheet data not available for 1933; 1932 figures used. †Shares outstanding reduced from 45,000,000 to 8,735,780 3/6.
‡ 1933 figures not available: 1932 figures used.
¶ Adjusted for twelve months on basis of nine months figures for 1933 available. § Stock grouped one for three between 1929 and 1933. "Paid in stock.

Business in the Southwest

By FRANK M. WILKES

General Manager Arkansas Power & Light Company

BUSINESS conditions in Arkansas are slowly returning to normal. The manufacturing plants are, of course, operating only part time, due to NRA requirements and limitations of various codes.

The farmers of Arkansas are in a better financial condition this year than they have been in the past five or six years as the government "plow-up" money, coupled with a crop close to normal on the remaining acres, resulted in the farmer being able to pay off all of his 1933 indebtedness and in many cases to clear up hold-over debts from preceding years. The prospects for further recovery during 1934 are, therefore, very good, especially if the government works out some form of rental of land so as to curtail the cotton crop next year. The rice farmers are enjoying the best prices for their product this year that they have had for the past three years and they, too, are getting in good financial condition.

From a utility standpoint conditions are gradually returning to normal in so far as operating conditions and loads are concerned. However, the attitude of the central government in regard to encouragement of municipal and government ownership is resulting in a great amount of unrest and rate agitation.

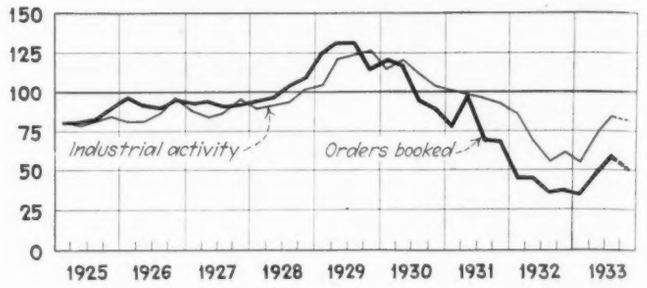
The last Legislature passed a bill providing for a fact-finding tribunal, whose duties are primarily to make valuations of all utility companies in the state with the idea of showing justification for general rate reductions. This commission is now busily engaged in the investigation of the various utilities, but so far has not completed any individual case.

From a financial standpoint the banks of Arkansas, with R.F.C. help, are now in very good condition, and it is hoped that no further financial difficulties will be experienced by any of them.

There will probably be a special session of the Legislature called between now and January 1, 1934, for the purpose of refunding the bond indebtedness of the state, but it is not thought that there will be any utility matters brought up.

Business in Electrical Manufacturing

Business turned in 1933.
An increase of 17 per cent estimated for 1934.
Effects of code yet undecided.
Optimistic opinions prevail.



ELECTRICAL manufacturers believe the ordeal by depression is about over and are thankful that they survived. Their value of products by the U.S. Census was $2,300,000,000 in 1929; this dropped to $995,500,000 in 1931; the estimated value in 1932 was $635,000,000 and the turn came in that year, for the estimate is $750,000,000 for 1933, an increase of about 18 per cent. A continued up-turn is anticipated, for the general estimate of manufacturers is for a business of $880,000,000 in 1934, an increase of 17.5 per cent.

Inevitably a drop in 1929 business, represented by the 1932 low of 73 per cent, wrecked the balance sheets of electrical manufacturers and practically all of them record deficits for actual factory operations in the past two or three years. In some instances outside investments and in others the sale of consumer goods sustained the situation, but especially those manufacturers engaged in the production and sale of engineering equipment found it impossible to make money under conditions of a business decrease to 80 to 90 per cent of the 1929 volume. Only by laying off men, working shorter hours and cutting expenses to the last dollar was survival attained and also, fortunately, the vast majority had written off the capital investment in plant and had no bonded indebtedness.

It is with a feeling of relief, therefore, that the electrical manufacturers look back upon 1932 and 1933 and make plans for 1934 on the basis of a continued slow but steady increase in the volume of business. The N.E.M.A. code with its increased costs and the rising level of prices will be carried provided sales increase, and an almost unanimous opinion exists that the tide has turned in this direction. Another year of wear-out and rust-out, the public works construction and the added sales to homes and industry are definite gages for anticipating more business this year. As tabulated from careful estimates made in the field, the accompanying table of engineering product sales shows an anticipated increase of 36 per cent in 1934 because of the combined effect of these encouraging shifts in the business situation. Only a serious disturbance of the national monetary situation can be expected to affect this business expansion in the opinion of careful observers.

Appliance sales are expected to increase about 25 per cent in 1934, with emphasis on the heavy-duty devices.

The electrical appliance business has held up unusually well, with electric refrigerators, washing machines and vacuum cleaners in the lead. More than 1,000,000 refrigerators were sold in 1933. Present aggressive sales campaigns and plans for domestic load building indicate an appliance business for 1934 at least 25 per cent greater than in 1933. The laggards continue to be ranges and water heaters, and yet it is expected that the industry will at last take these devices seriously and sell them. The lamp business received a welcome and very decided

Electrical Machinery Apparatus and Supplies

By Class and Value. Based on U. S. Census

	1929	1931
Number of establishments	1,802	1,389
Wage earners	328,722	180,064
Wages	$456,377,629	$204,439,546
Cost of materials, fuel, energy	971,017,623	337,304,003
Total value of products	2,300,915,572	995,488,549
Value added by manufacture	1,329,897,949	658,184,546
Generation, m.-g. sets, automotive generators	80,932,360	33,951,086
Transformers, induction regulators, reactors	84,032,353	42,709,918
Control apparatus	44,288,544	22,159,126
Electrotherapeutic and electromedical	23,555,082	9,060,690
Motors, motor parts and supplies	194,845,523	94,707,742
Electric fans	10,196,353	8,648,690
Batteries and battery parts and supplies	149,934,676	85,945,271
Lamps, X-ray tubes	85,319,515	70,426,394
Industrial and commercial apparatus and appliances	28,636,977	16,777,045
Household apparatus and appliances	84,485,468	50,983,388
Switchboards, circuit breakers, switches	81,201,122	44,283,200
Ignition apparatus for internal combustion engines	58,627,039	27,805,983
Insulated wire and cable	312,592,093	120,632,610
Wiring devices	38,395,283	21,750,099
Conduits and fittings	58,157,565	29,082,516
Fuses and fuse blocks	14,036,325	7,741,381
Miscellaneous	530,973,804	260,486,086
Radio receiving sets	.....	116,424,422
Dish washers	3,424,028	1,955,697
Elevators and elevator machinery	44,044,399	20,407,463
Electric sewing machines	27,626,542	17,274,159
Vacuum cleaners	35,107,606	23,839,868
Welding machines	10,729,643	6,667,866
Washing machines	71,388,144	42,448,187
Ironing machines	4,015,222	2,738,268
Condensers	4,386,004	2,256,659
Steam turbines	2 ,934,420	12,736,656
Waterwheels and turbines	5,027,907	6,889,351

stimulus from the better light campaign, and dollar sales equaled those of 1932 despite lower prices. The wattage and the number of lamps sold increased greatly.

Effect of code

The chief effect of the N.E.M.A. code to date is the institution of the wage and hours of labor clauses, thereby increasing costs of production. A second more or less intangible effect has been the forced association of all manufacturers to arrive at agreed upon trade practices. Products have been divided into seventeen groups, with code authorities for each group, and these unit groups have been trying to formulate supplementary codes that outline trade practices. So far very little definite action has been had, although hours of debate and consultation have been expended.

Questions such as allowable differentials between large and small manufacturers, discounts permitted with volume of purchases, margins allowed to wholesalers, distributors and retailers, the use of published price sheets, the rules for time delivery and the institution of cost accounting and statistics cannot be answered readily to the satisfaction of all manufacturers in each group. In a very positive sense a detailed supplementary code has been found to infringe upon individual company management policies and the unsettled markets make it difficult as well as questionable to fix normal prices and arrangements. Nor is it yet known what is enforceable and what is not. The time delays involved are understandable and yet progress has been made, and there is a general feeling that the present questions will be answered satisfactorily. Undoubtedly, too, ambitious and too-detailed programs will hit many rocks, for industry cannot reorganize and change its practices in a day.

While the code thus more or less disturbs business and requires attention by executives, the field sales forces are after business. Competition is keen, prices have been increased 10 to 20 per cent, chiseling still exists and the customary practices are in vogue. Price cutting is no better and no worse. Despite these usual conditions the manufacturers are ready to do business and are optimistic about the up-turn for this year.

In 1929 the value of manufactured product per wage earner was $7,000; in 1931, $5,500, a decrease of 21.5 per cent. In 1929 the wages paid per man was $1,390; in 1931 they were $1,130, a decrease of 18.7 per cent. Stated in another form, the wage payments in 1929 per dollar of manufactured product value were 20.2 cents and in 1931 the value had changed to 20.4 cents. Thus despite a decrease in the dollar volume of business of 57.5 per cent the cost of wages per dollar of sales was unchanged. It is evident, however, that an effect equivalent to the share-the-work movement was instituted whereby the annual income per wage-earner was decreased in order to retain more men at work.

Estimates of Manufacturers' Sales in 1933-1934

Class of Product	1933	1934
Steam turbo-generators	$9,500,000	$10,500,000
Waterwheel generators, frequency converters and synchronous condensers	4,600,000	6,500,000
Power transformers	3,000,000	7,500,000
Distribution transformers	8,000,000	11,600,000
Induction motors, under 200 hp	14,000,000	22,000,000
Induction motors, over 200 hp	9,000,000	12,500,000
Fractional-hp. motors	26,000,000	32,000,000
Synchronous motors	3,000,000	4,000,000
Control apparatus	15,500,000	18,600,000
Industrial heating devices	3,500,000	4,400,000
Electrical meters, watt-hour	5,000,000	6,000,000
Switchboards	4,500,000	5,500,000
Oil breakers	4,200,000	5,500,000
Air breakers*	2,000,000	2,400,000
Knife switches*	2,100,000	2,300,000
Metal-inclosed switchgear	800,000	1,000,000
Total	$114,900,000	$152,300,000
Per cent increase = 32.5		

*Not included in switchboards.

Net Incomes of Representative Electrical Manufacturers

	1932	1931
Acme Wire Company	(d)167,982	(d)213,325
Air-Way Electric Appliance	(d)397,935	(d)382,927
Altorfer Bros.	(d)171,710	(d)236,103
Allis-Chalmers Mfg.	(d)2,955,043	1,256,431
American Transformer	(d)69,759	(d)9,284
Anaconda Wire & Cable	(d)1,045,110	18,681
Apex Electrical Mfg.	157,549	223,762
Arrow-Hart & Hegeman Elec	(d)169,623	250,713
Automatic Washer	(d)232,588	(d)234,228
Belden Mfg.	(d)231,044	(d)227,343
Benjamin Electric Mfg.	(d)295,984	246,931
Birtman Electric	(d)5,987	56,092
Black & Decker Mfg.	(d)798,312	(d)709,850
Bright Star Electric	(d)97,650	(d)109,116
Chicago Electric Mfg.	(d)9,714	2,958
Century Electric	(d)389,736	(d)49,099
Claude Neon Electric Prod	400,659	664,894
Crocker-Wheeler Elec. Mfg.	(d)429,278	(d)228,346
Cutler-Hammer, Inc.	(d)738,110	(d)501,020
Copeland Products, Inc.	(d)693,870	314,411
Driver-Harris	(d)378,671	(d)275,956
Easy Washing Machine	(d)144,619	219,347
Edison, Thomas A., Inc.	(d)399,000	(d)203,000
Electric Controller & Mfg.	(d)369,890	(d)106,146
Electric Auto-Lite	1,364,059	3,913,833
Elwell-Parker Electric	(d)117,124	(d)10,032
Electric Household Utilities	(d)203,447	(d)424,990
Electric Storage Battery	1,259,859	2,770,458
Eureka Vacuum Cleaner	48,110	(d)1,163,096
Fairbanks-Morse	(d)2,481,938	(d)5,168,054
Federal Electric	(d)207,701	362,096
Formica Insulation	(d)56,138	127,830
General Electric	14,404,110	40,956,996
Gamewell	171,376	740,347
Grigsby-Grunow	(d)2,775,569	(d)2,901,305
Hoskins Mfg.	56,774	222,410
Hygrade-Sylvania	851,527	1,414,269
Kelvinator	102,701	1,761,709
Landers, Frary & Clark	(d)75,916	711,773
Line Material	(d)216,250	131,100
Manning Bowman	(d)125,242	(d)260,785
Maytag	100,773	1,013,291
McGraw Electric	(d)269,124	188,931
Moloney Electric	136,718	39,044
Ohio Brass	(d)878,828	(d)113,773
Otis Elevator	307,519	4,414,963
Sangamo Electric	(d)263,931	393,549
Servel, Inc	(d)777,443	1,067,397
Wagner Electric	(d)181,158	348,748
Westinghouse Elec. & Mfg.	(d)8,903,540	(d)3,655,660
Weston Electrical Instrument	(d)143,354	122,265

Courage, but What About Confidence?

By J. B. WHITEHEAD
President American Institute of Electrical Engineers

COURAGEOUS men everywhere are looking forward to the new year with hope, though perhaps not with open expression of confidence. There are many good grounds for hope. There is less distress and unemployment, the banks are open, the railroads are feeling somewhat better, the farmers have stopped striking, the NRA seems to be working, there are noticeable increases in business, past depressions have not lasted longer than five years and so we should be near the upturn. All certainly good grounds for hope.

But we hear few expressions of confidence, even from government. Experiments in government are under way, and described as such by those initiating them. Experiments with great forces whose laws are unknown. Can it be good economy under any circumstances to enforce curtailment of production, to pay labor not to labor with one hand, and to pay labor for unnecessary labor with the other?

Is the decrease of distress due to re-employment or to the dole? Is re-employment due to NRA or to natural economic causes? Is the government properly advised in the economics and engineering of hydro-electric and steam power generation, and is Muscle Shoals an example? Can unlimited outpourings of money for unnecessary projects give any other than transient employment, or leave us other than poorer in hard times? And how is all this to be paid for and by whom? Avowedly by taking the profit out of business, by further taxes on industry, and on the thrifty and provident. Hard teachings to accept! Costly experiments! Confidence? Hardly!

But certainly courage and hope! In fact, they are evident everywhere. Can there be anything more heartening in a long-range view than the moderation, tolerance and fortitude with which our people have accepted the hardships of the times and the guidance of a government cutting loose from proved moorings of the past, and embarking on voyages to hazy seas of idealism?

This attitude is obviously founded on two salient faiths: First, the willingness to give a great and courageous President, who has promised not to let experiments go too far, his chance to lead us out; and, second, an abiding certainty that the enterprise, industry and courage of the American people, together with the natural resources of our country, can only result ultimately, though sometimes checked, in prosperity and contentment.

The electrical industry has shown a fine example of this attitude. Manufacturers have shortened their rations, tightened their belts, co-operated with government and played the game. Utilities have done the same, and with admirable grace in the face of frequent misrepresentation, prejudice and unfair regulation and competition. The devotion, loyalty and patience of individuals has been superb. Service and co-operation are of the very spirit of the electrical industry. Confident that better times are in sight and that every enterprise calls for that service and co-operation, the industry carries on with courage, hope—yes, and with confidence!

ENGINEERING REPORTS AND OPINIONS

THE editors of ELECTRICAL WORLD have made a careful survey of the status of engineering in the electrical industry. Through the co-operation of engineers in utility, industrial and electrical manufacturing ranks they have obtained information on new equipment, new technical developments, current trends and opinions.

An analysis of these reports and studies has been made and is published in the following articles. The editors have made positive statements and definite interpretations based upon their own opinion and knowledge and upon those whom they believe most competent. All engineers will not agree with some of the conclusions and statements and a discussion of other points of view will be welcomed for publication.

It has been the purpose of the editors to fill the gap left by the cessation of committee activity and decrease in travel and contact that resulted from the depression and changes in industry organization and policy. The following material, in a sense, is a series of reports compiled and interpreted by the editors for the benefit of the industry. The task has been difficult and the work laborious, but it is hoped that the industry will find the results informative and suggestive. The editors wish to express their great appreciation to those engineers who co-operated in making these reports possible.

Trends in Power Generation

Lower costs available.
Simplicity governs.
Several new developments.
Multiple stations favored.
Government pushes hydro.

WHEN the depression started in 1929 the generator rating of utility plants aggregated 31,952,396 kw. and the output was 97,352,000,000 kw.-hr. In 1933 the generating capacity was 36,205,245 kw. and the output 85,552,000,000 kw.-hr. Thus, on the surface the utilities have increased their capacity 4,300,000 kw., while the output has been reduced 12,000,000,000 kw.-hr. This is not the complete story, however. Careful estimates of new devices sold during these years give an added connected load of about 42,000,000 kw., which may be translated into an added demand on stations of 4,200,000 kw. Thus this new demand, plus a demand of some 2,000,000 kw. that would result from a return of the industrial load of 1929, more than offsets the increased capacity added to stations. Business recovery plus business sold during the depression would bring an immediate demand for new station capacity.

Few new power stations have been undertaken during the past four years, the operating plants have depreciated rapidly and steadily, great technological progress has been made in equipment and the economics of power generation has changed favorably for the construction of new stations. All the elements give a present-day situation that necessitates very careful study. This study involves:

(a) Prospects of a return of business and the consequent demand upon stations.

(b) Degree of economic obsolescence of existing plants and the economics of rehabilitation versus building new stations.

(c) Factors in competition and in changed values for transmission and distribution costs that affect the size, the location and the operating requirements of present-day and future generating stations.

During this depression the utilities have concentrated upon endeavors to reduce the operating expenses of existing stations and to add as little as possible to capital costs. Manufacturers, despite a cessation of orders, have gone along with research and new developments very rapidly and are now ready to build equipment superior in design and materials to anything now in use. Undoubtedly a return of load will find those interested in power generation ready to install new capacity that will give economic and operating results superior to those now existing. Just now standby operation and arrangements to take sudden loads is a problem on large hydro-fuel systems.

Trends in Steam

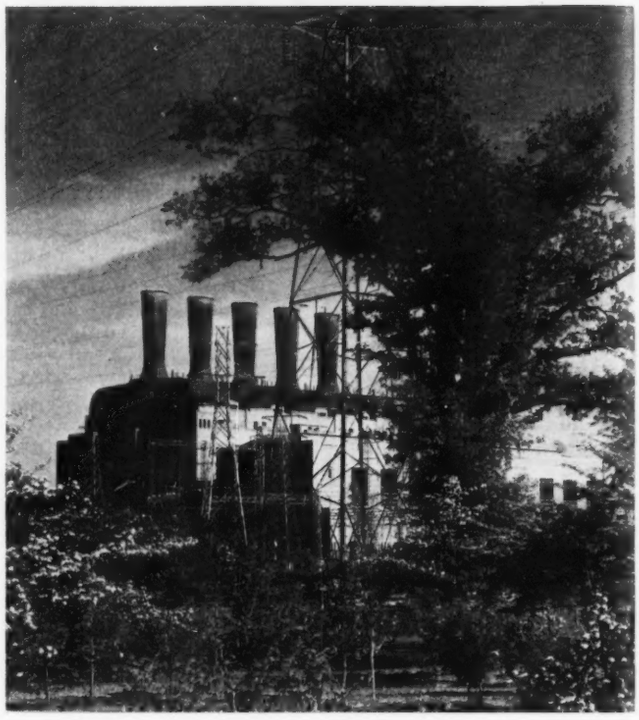
At the present time the best practice in fuel-burning steam stations gives a heat consumption of about 12,500 B.t.u. per kilowatt-hour at switchboard costs ranging from 3 to 5 mills. This cost is made up of about 70 per cent fixed charge and 30 per cent operating charge. Under these conditions, except under special circumstances, it is difficult to justify improvements in thermal efficiency and this fact has handicapped the advance toward higher pressures, higher temperatures and the use of heat traps and refinements that might improve the thermal performance. Both capital and operating cost increases frequently offset the decrease in fuel consumption.

On the other hand, the vast majority of existing stations fall far below the best practice standard and offer a market for rehabilitation either by direct replacements or by the addition of high-pressure or mercury boiler units. In addition the new stations to be built offer many opportunities to save money on the assembly and construction so that a "best practice" station of today can strive for a capital cost of about $70 per kilowatt, as contrasted to $100 per kilowatt five years ago.

The effect of the codes upon the cost of equipment, construction labor and fuel must also be considered. All these costs will be increased, but apparently fuel will increase more relatively, thus offering opportunity for the installation of higher efficiency stations.

Conceptions as to the size and location of steam stations have changed. The day of the giant station with mass production in a single location appears to have passed in favor of the use of several smaller stations located more advantageously with respect to loads and tied together by transmission. The use of the high-capacity-unit generating plant, the competition afforded by the industrial plant, the relatively high cost of transmission and distribution in congested areas, the very small if not negligible margin involved in the unit cost of, say, a 100,000-kw. and a 1,000,000-kw. station and the slower growth of load and the prospects of technological improvements in future additions—all these contribute to influence power generation by means of multiple-unit stations instead of the older increment expansion type of giant station. In many instances, as an extreme, station capacity is added by the use of generating equipment in industrial plants using process steam.

Performance of 1,200-lb. stations has been satisfactory and both manufacturer and operators have confidence in the efficiency and reliability of equipment in this range. The necessary increase in steam temperature to permit the full economic use of this pressure without the complication of reheating will add to the more general adoption of this pressure. This high-pressure type of station will come into more prominence as an agency to use to rehabilitate old low-pressure stations. But based upon normal load factors and over-all results, stations of 700-lb. pressure and temperatures from 850 to 900 deg. are apt to be most numerous for new stations. The chief argument for this type of station is simplicity and reliability. Turbine inlet-steam temperatures of 850 deg. F. have been tried and found practical, and with a restriction of the wetness of the exhaust steam to about



Promising experiments on high-temperature steam are being made by the Detroit Edison Company

10 per cent the pressure may be raised to 650 lb. per square inch for 29-in. vacuum, giving a turbine efficiency of about 85 per cent. During the year one manufacturer has announced the completion of detailed design studies for a 200,000-kw. turbo-generator to operate at 1,200-lb. pressure and 1,000 deg. F. steam temperature without resuperheat, and is prepared to build such a machine. There is also a demand for larger back-pressure units.

If it is desired to get heat consumption below 12,000 B.t.u. per kilowatt-hour high pressures and high temperatures must be used. The answer to this appears to lie in fundamental developments of forced circulation boilers with pressure combustion chambers. Several of these types have been developed in Europe, but they are still in the embryonic state for use in the American type of station. More hopes for quick developments lie in the Detroit experiments to use 1,000 deg. F. for inlet-steam temperatures.

Possibly the most marked trend at present is toward the use of simplicity in station design and the installation of high-capacity units. Both these trends are to get maximum over-all economy and operating reliability. New plants are planned for space saving and architectural ornamentation and special building materials are giving way to less expensive structures using ordinary materials. Designers have gone a long way to reduce piping; for example, cross-over connections and spare pipe lines. Simplification is applied to auxiliary power supply, switchboard design, electrical connections, by-pass connections, the number of stage bleeder heaters and power station floor arrangements.

The ideal is to use only essential equipment and to make each assembly a unit that operates as a unit. The day of the single boiler, single turbine, single auxiliary equipment designed as a unit assembly with unit controls

is here and there promises to develop a greater amount of factory-built single-contract power station installations in the near future. The principle of the one-bedplate, single-unit, internal combustion generating station is being applied to steam plants. The outdoor generating station is designed, but it is very debatable as against the older type station. The operating disadvantages offset the very questionable savings in building costs.

Many station designers favor the high-pressure, high-capacity units using a relatively small amount of boiler heating surface and a relatively large economizer section and a large air heater. These boilers have a high steaming capacity per foot of width and are usually set over a completely water-cooled slag-tap furnace that uses pulverized fuel firing. Pulverizers with a capacity of 80 tons per hour are in use. With the growing use of high steam temperatures the control of superheat as well as economical design has caused changed designs and arrangements. One plan is to keep the amount of boiler heating surface in front of the superheater to the minimum required for safe temperatures for superheater tubes and to use two-part superheaters with desuperheaters for the purpose of controlling superheat temperatures under variable loads. Other arrangements call for proportioning the radiant and convection superheater tubes. The design of drums and arrangements to prevent moisture and solid matter going to the turbine have been improved greatly. Research is needed on radiant heat transfer, and on the possibility of more luminous flames to get full efficiency from these new developments.

Feedwater treatment, in the broad sense, is one of the most important technical problems confronting power engineers. At pressures above 400 lb. carry-over material in steam gives trouble in superheaters and turbines. Research of a thorough and fundamental character should be made to find what actually happens in boiler water under high pressure where evaporation rates are high and the circulation rapid. This research involves devices for purifying the steam between boiler drum and superheater and also feedwater treatment to overcome scale and priming conditions.

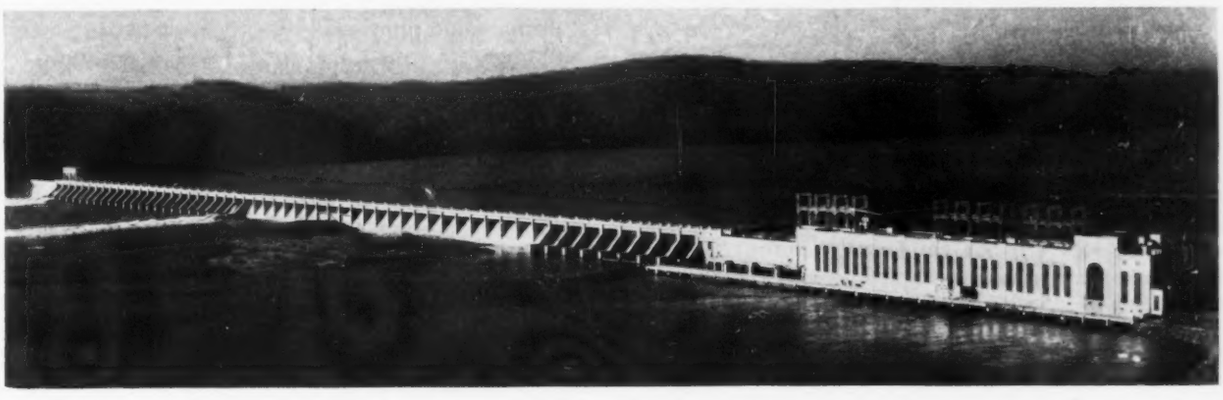
For large units both pulverized coal and stoker firing are used. Stokers are larger and use zoned air control. The tendency is toward direct firing with the pulverized coal system. Also the recent changes in prices of fuel have created a demand for boilers equipped to burn one of several fuels readily. The slag-tap furnace with water or air-cooled bottom is favored for high-capacity units except where only high ash fusing temperature coal is available. About 75 of these furnaces are in operation or on order. These furnaces have been designed for rates of heat release of 40,000 B.t.u. per cu.ft. per hour at normal continuous ratings, with provision for 10 per cent higher ratings under peak conditions. Oil and gas burners of larger capacity have been developed to conform to the increased demand for oil and gas as fuels. Flue gas scrubbers and dust collectors have been developed because of the demand for removal of fly ash from solid fuel-fired plants.

The perfection of welding technique has resulted in more use of welded plate construction and this tendency has extended to welded pipes and flanges. One of the chief objects of attention has been the fireproofing of turbine lubricating systems. Several fires raised the question and much work has been done to isolate the oil piping from high-temperature steam pipes, to insulate pipes and to arrange locations for oil so that neither oil flow nor a volume of oil is exposed to fire hazard. One new station has put oil storage on a separate floor and arranged high-pressure pipes so that they are inclosed in return oil pipe lines so that any possible leak could not create fire hazard. Another approach to this problem is to get non-inflammable lubricants and progress has been made.

Mercury turbine developments

The 10,000-kw. mercury turbine at Hartford continued in commercial service throughout the year and the two 20,000-kw. mercury units at Kearny and Schenectady went into successful operation. These installations point the way to new developments toward simplified designs and lower costs and this type of generating unit promises to have a marked influence upon the rehabilitation of older stations and upon the design of relatively small new stations for utility and industrial power stations. In Europe experiments have been made using aluminum bromide boilers with promising results.

Industrial plants are greatly interested in power and have been buying small turbines up to 650 lb. pressure. Process steam is being considered as a heat sump, is available for a larger part of the year than heating steam and yields a greater amount of firm power as a by-product. Combination utility-industrial power stations are receiving greater consideration.



Safe Harbor is the latest plant to embody new developments in hydraulic engineering

Diesel engines continue to be acceptable and economic sources of power in many installations. The year witnessed the large installation at Vernon, Calif., and it is hoped that full cost accounting will be had on this large plant in order better to place the Diesel as a generating source. Small Diesel engines have been improved and sold. Research work has been done by several concerns and rumors are about that single-bedplate small Diesel plants will be on the market soon at prices ranging from $40 to $60 per kilowatt.

Trends in Hydro

For the past two or three years the construction of hydro-power projects by private power companies has, of course, been almost exclusively confined to the completion of projects already under way or to which the owners were already committed. In a few cases, also, additional units have been installed, especially where, because of provisions already made, the new money involved was relatively small.

The place of water power "in the sun" of the future will depend upon careful study and appraisal of its value in combination with fuel-generated power, as was done, for example, in connection with the Conowingo and Safe Harbor developments. It has been pretty conclusively demonstrated that neither water power nor steam power alone can supply the lowest average cost power, except where conditions are particularly unfavorable for one or the other.

The lull in construction and business activity has not been without its benefits, however. Engineers and operators have had the opportunity (often born of the necessity to reduce expenses) to review the design and construction of their plants and equipment and their scheme of operation, with a view to cutting the operating and maintenance costs. The results have often been surprising. Many plants have been improved, both in mechanical and electrical efficiency and in cost of operation, at relatively small cost.

New governors and improved governors

In large systems containing many hydro units some of the older may have very poor governors, or none at all. Intermittent operation of such units causes little or no disturbance to operation, hence the governing and synchronizing devices may be very elementary. On one system direct-current motors and suitable reduction drives are being tried out as substitutes for obsolete governors and hand control of gate mechanisms. Direct-current motor drive supplied by station storage batteries offers an opportunity for reliable, local and remote or supervisory push-button control, including remote manual speed control for synchronizing where automatic synchronizing devices are not employed. Automatic shutdown, actuated by speed-switches, is another feature of these applications. Several improvements and one or two new governors have been developed by manufacturers that promise to give better performance and closer regulation.

The trend toward automatic, or partial automatic, operation has been greatly accentuated recently by the realization that important money savings in operating expense may be thus realized. The automatically adjustable blade (Kaplan type) hydraulic turbine is bound to enjoy greater popularity in the future. Its inherently wide range of operating head and load with high efficiency adapts it to use in single-unit installations where stream flow, head and load are widely variable. These characteristics also make it possible to reduce considerably the number of units in many multiple-unit installations. One manufacturer has a self-adjusting automatic turbine runner in process of development that is promising.

The tendency to build large single-unit plants is strong in interconnected systems, except where pondage is extremely limited. Even in such cases, where the combined capacity of a group of plants relative to the system load is small, they are all often operated intermittently at constant power by headwater-level control, thus utilizing all available water at good efficiency.

Operators suggest simplicity in assembly

Operating men would appreciate greater attention by the manufacturers to those matters of design and construction that have to do with the ease and cost of maintenance, the ease and permanence of adjustments and certainty of proper lubrication, as well as a reasonable life for parts which are costly or slow and difficult to replace; for example, design, location, etc., of parts of bearings, of the gate mechanism, the runner, etc., so that parts may be removed installed and adjusted readily and *without dismantling* other parts of the assembly, or perhaps the entire unit. While this ideal will probably never be reached, a much nearer approach is possible through proper design based upon operating experience.

The effort being made by one of the manufacturers to develop and market a line of "stock" turbines of the adjustable-blade type, in which the blades also serve in place of the customary guide vanes, is a step in the right direction. If high-efficiency hydraulic equipment of the small and medium sizes can be economically standardized, and sold at lower prices, it will tend toward greater sales of such equipment for replacements, redevelopments and new projects.

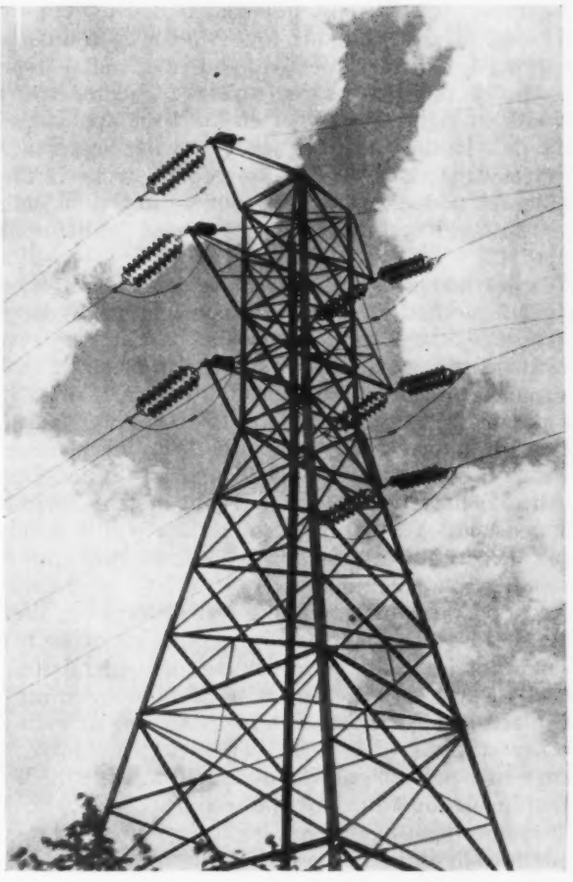
The economics of power development and production now, and for an indefinite time in the future, urgently demand the utmost conservation of capital and the lowest operating expense consistent with the reasonable certainty of carrying the load.

Ornate and unnecessarily expensive hydro power plant buildings, etc., must tend to give way to substantial structures of pleasing, yet utilitarian, design and finish, achieved by proper design and disposition of ordinary material, rather than by the use of expensive or unnecessary quantities of materials.

Simplification, reliability and economy were never more necessary in hydro-power plant design, construction and operation than now, and they probably will be as essential in the future. In Europe the pumped storage plant continues to be in favor, and one of the latest installations uses the same turbine as both a pump and a prime mover at required intervals. At present the greatest impetus to hydro development in this country is coming from the government projects now started and in contemplation.

Transmission and Overhead Distribution

Survey of trends.
Many new devices.
Present ideas on protection.
Possibilities for expansion and rebuilding.
Stability and insulation co-ordination.



ALTHOUGH few new high-voltage transmission installations were made in 1932 there was considerable progress in the art and notable developments in equipment. Studies of present installations, designs for new installations, agreement on protective methods, progress in insulation co-ordination and the development of new devices gave transmission engineers knowledge and facilities to build more economical and more serviceable lines.

Despite continued experimental effort to develop the vacuum tube to give high-voltage direct-current transmission, insufficient progress has been made to warrant statements that alternating-current transmission will have a serious commercial competitor in the near future. Nor does the very optimistic faith of the T.V.A. in the Van de Graaf generator as a transmission device seem warranted as this is simply an electrostatic generator. Researches with alternating current make possible overhead lines up to 400,000 volts as commercial projects and underground cable lines up to 200,000 volts, and these values are well over the limits required in practical installations because each year witnesses a decrease in the economic distance for transmitting electrical energy. Despite wild dreams to link the Tennessee, the St. Lawrence, Boulder Dam and the Columbia in a bulk transmission system, a dollar and cents analysis shows that such a scheme is uneconomical as well as impracticable.

During 1932 the Niagara, Hudson and New York systems were linked with a line that embodied new and complete protection against lightning by the use of overhead ground wires and an underground counterpoise, and the results of operation show practical immunity from lightning hazards. During the year 1934 the two lines to be built by the T.V.A. from Norris Dam to Cove Creek stand out and the Boulder Dam-Los Angeles line will have many new features in transmission design and equipment. It is designed for 270,000 volts and will use a hollow segmental copper conductor for the first time in this country. This new long-distance line will afford valuable data on the upper limits for practical transmission.

The technical problems in transmission quickly reduce to economic considerations. Costs and service fix the type of line, the protective features and the accessory devices to use with a line. For high-voltage, large-capacity, long-distance lines engineers agree upon the steel tower type of structure as best practice, but whether it is cheaper to make a single lightning-proof, flashover-proof line with full protection, communication and switching features in contrast to the use of two parallel lines with less elaboration in equipment for each line is an economic problem in costs and service that must be decided for each case. There is a decided trend, however, to restrict the steel tower line to lines of major importance and magnitude and to use wood pole lines for all other applications.

Economic and service advantages continue to favor the trend toward the use of wood pole lines for intermediate-voltage, relatively lightly loaded lines. The first cost, the insulation values, the better known life of treated wood poles, a better knowledge of protection against lightning and flashovers on wood pole lines make these lines very advantageous for use. The use of wood crossarms, wood crossarm braces and wood for strain insulators is growing in favor rapidly and is dictated by the desire to increase insulation values and reduce costs.

Developments in lightning protection

During 1933 operating experiences with lines confirm previous ideas that lightning protection is provided adequately if overhead ground wires are used and the tower-footing resistance is low. The ground counterpoise with the overhead ground wire is the most complete answer

to lightning, but the cost involved is a deterrent to installation. The continuous tower-to-tower counterpoise has proved entirely effective and the radial type is effective if the lengths are made adequate, but lack of width in rights-of-way often limit the application of this type. In the field there is a growing acceptance of the theory that a stroke on the ground wire, if tower-footing resistance is low, will not permit sufficient potential to build up on the tower to cause insulator flashover.

A better knowledge of current values in lightning discharges is needed in order to fix insulation levels more definitely. Surge crest ammeters have given revised opinions as to the magnitudes of current in direct strokes to ground. Records from 5,000 to 65,000 amp. show considerable reduction from the 150,000-amp. values indicated by tower leg potential-drop measurements. Towers on the systems of the American Gas & Electric and the Pennsylvania Power & Light systems have been equipped with these ammeters and data will be available soon. Practically all readings obtained thus far have shown negative potential.

On wood pole lines, opinions still differ as to the use of overhead ground wires only, grounding of each pole and more or less complete shielding. A general trend is toward the use of shielded protection in lightning exposure areas and the omission of grounding at each pole in other sections of a line. The relatively infrequent damage to a pole or poles is measured against the better normal insulation values of the wood.

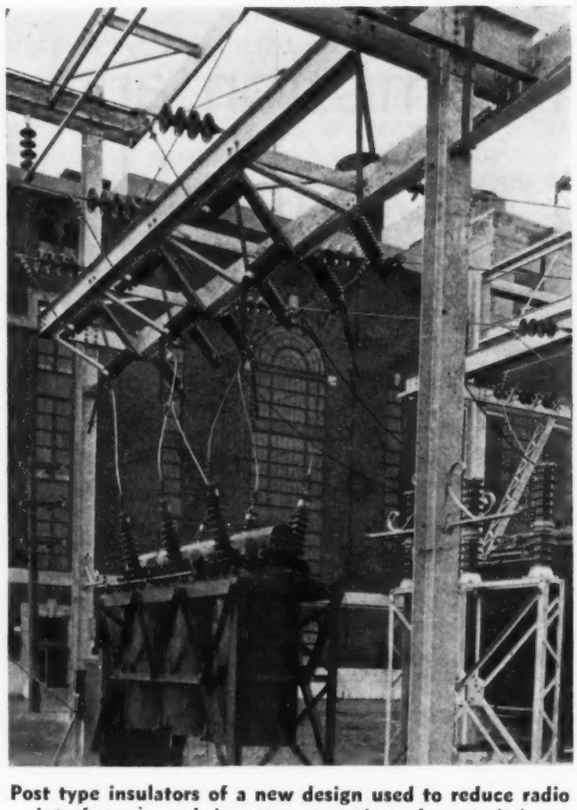
More development is occurring to measure the practical possibilities of anti-flashover and lightning surge-dissipating devices for installation on the insulators or at frequent intervals on a line. Some promising tubes such as the Torok and Pitman are used and more experience with these devices will enable engineers to measure the technical and economic aspects of these protectors.

Mechanical features

Conductor vibration on some lines is a problem, but the use of Stockbridge dampers and similar types reduce the vibration to a negligible amount at a relatively slight expense. Better designs of clamps, more care in fixing tensions and improving the mechanical features of installation also help toward the solution of the vibration problem. Research is also under way of a more fundamental character to improve the characteristics of the conductors against fatigue. Valuable information has been obtained on guying, bracing for wood poles and other mechanical features of lines during the year.

Stability problems were not so dominant last year. Better prime-mover governing, lighter loads, more flexibility in loading systems so that stability is maintained, faster switching, more accurate relaying and a better knowledge of stability and stability limits permit the industry to advance without serious concern over a problem that was acute and vexatious four years ago.

Interruptions occur on network transmission systems, and instruments such as automatic oscillographs are and should be installed to measure values when these occur. Care must be taken to filter out switching surges and to get operation of the instruments under all conditions of service interruption if this survey method is used. It is also necessary to do some development work on system relaying before the art can be considered satisfactory on network transmissions. The distance, impedance and reactance type relays are correct in principle but difficult to install so that precision action will result for a particular type of disturbance and yet be selective as to other disturbances and as to the section of line affected. Too frequently synchronizing power transfers are interpreted as fault currents by these relays. Rapid changes in relay design also call for a simple design with readily replaceable functional parts. Research with the use of signal currents, carrier currents and other relay controls is being conducted to give more precise, selective and reliable relay systems.



Post type insulators of a new design used to reduce radio interference and improve operating characteristics

Insulation co-ordination advances

An ideal sought is to fix insulation levels more definitely on lines and on terminal equipment. The theory is to arrive at less expense, greater reliability and predetermined performance. The basic device for measuring levels is an inclosed gap, and work to date is largely concerned with fixing relative levels of insulation on terminal equipment in terms of the unit gap. Since exposed bushings and terminals vary in insulation value with exposure conditions, it is difficult to give them an insulation rating. A current suggestion is the installation of the inclosed limiting gaps on transformer and breaker tanks that will spill over without damage if a predetermined potential is reached. This reference gap is thus suggested as an installation device on terminal equipment, but some say its limit is too close to the test levels of terminal equipment and that its sharp cut-off characteristic is as bad in effect as a steep front surge. Another school advocates the arrester as the primary protective device, with the reference gap as a

back-up. Thus insulation co-ordination has not progressed far and is still debated. The insulation of terminal equipment, however, has been improved greatly and is quite definitely fixed in terms of steady and impulse values. In theory, co-ordination saves money by enabling the industry to hold down built-in insulation because of external protection, but so far there is no evidence of a positive economic application of the theory.

Considerable progress has been made in improving terminal equipment bushings, but much remains to be done. Both the mechanical and electrical characteristics of present bushings need improvement and research work is being done to bring this about. Much good work has been done also to make transformer, oil breaker and other oil-filled apparatus simpler in construction and more moisture proof. Welding fabrication has aided this greatly.

Switches and fuses

The general trend in transmission is toward instantaneous disconnection of a faulty line or link and then the instantaneous reconnection of the link if the trouble clears. This means that one great object of designers of switches is toward faster action and a greater use of reclosing action. As a consequence oil breakers are available for action in from 3 to 6 cycles and projects are under way to rerate breakers so as to embody some form of specification for several successive and very rapid opening and reclosing cycles. Continuity of service is greatly improved by use of reclosing breakers and experience shows that many faults clear themselves almost instantaneously.

This same principle is applied to the use of high-voltage fuses. These are applied to rural and dead-end lines and progress is rapid toward the development of what might be called reliable reclosing fuses for this service to replace the more expensive oil breakers. Two or three multiple or reclosing high-voltage fuses are available and one very promising automatic type is in use. The great amount of rural line construction also has called for a fuse that drops out of position or otherwise indicates the necessity for maintenance after it operates, and several of these devices have been brought out this year. High-voltage fusing is making good progress and promises to have great influence in making possible economical line extensions.

Oil circuit breakers

The high-voltage oil breaker has been improved very greatly during the year. It has been made faster, more reliable and, in general, better design has improved its operating characteristics and reduced its size per unit of rating. Many breakers already installed have been modernized during the year. Especially significant has been the reduction in space requirements of breakers of a given rating, whereby a saving of about 50 per cent has been had in the space occupied over the past five years. A second trend has been to improve the operating mechanisms of breakers and to increase their speed of operation. Depending upon type of breaker, the time of operation has been reduced to 6 or 8 cycles for the larger breakers and some new developments give promise of 3 to 4 cycles. This will make possible better service for transmission lines.

The Deion principle has been extended and applied by the Westinghouse company and especially noteworthy advances have been made in using this principle for air breakers during this year. The General Electric Company has developed a very interesting high-voltage breaker during the year. It uses the piston type oil-blast principle, but is unique in that it is designed as a single-pole breaker. The entrance bushings contain parts of the mechanism and the arcing distance, as well as the volume of oil per pole, has been reduced very greatly, with a consequent reduction in space requirements and time for operation. This company has also marketed a low-voltage breaker that uses an air-pressure chamber for arc extinction. The Condit company has developed a new design of breaker for large motors, a new high-speed motor operating mechanism and a new frame- or pole-mounted type of outdoor breaker.

Researches on circuit breakers using gas, pressure, chemicals, and other principles have continued during the year, but nothing has been developed that is as significant as the very rapid improvements that have been made in oil breakers. Promising possibilities exist also for the development of non-inflammable dielectrics to replace oil in breakers. One by one the limitations faced in oil breakers have been eliminated.

Transformers sold as assemblies

Transformer developments during the year continued. The insulation was improved, potential distribution in the event of surges was taken care of to give more uniformity of distribution in the windings and the advent of impulse testing created considerable pro and con technical discussion. A second trend influenced by buyer demands was the development of possible short-time high ratings by use of some means of forced cooling. The use of "Pyranol" instead of oil offers advantages for transformers in special applications.

A very positive welcome was given to the development of a combined transformer and regulator by the General Electric and Allis-Chalmers companies. This equipment is used on dead-end lines connected to main transmission lines and serves as a transformer and voltage regulator. It permits medium high-voltage distribution lines to be regulated, thus giving better service without necessitating the purchase and installation of transformers, regulators and accessory equipment.

Debate is had as to the use of arresters or discharge gaps inside the cases of transformers, especially distribution transformers. These surge-limiting and protective devices may or may not increase the hazards and the maintenance costs, and more field experiences are awaited before commitments are made by some manufacturers and some utility engineers. Others favor this type of installation because of the compact arrangement of transformer and protective device and because of their belief in the efficacy of the protection. Considerable progress has been made with transformer cutouts and several new types are now available.

Insulators found worthy

The high-voltage insulator for transmission lines is deemed very satisfactory. Very little complaint has been found and failures are so few as to be negligible. Terminal bushings also have been improved, but are not yet fully satisfactory. A new type of station and line post insulator has been developed by the Lapp Insulator Company with claims of superior characteristics particu-

larly in regard to radio interference and strength under power arcs. A one-piece high-voltage pin type insulator has been developed by the Porcelain Insulator Corporation and pin type insulators have been gaining in favor for intermediate voltage lines. Line hardware has been improved to reduce radio interference and to give stronger and simpler construction.

In the lower voltage distribution field one important development this year appears to be the promise of a better weatherproof wire. The researches at Purdue were promising and more work is under way. Installations with the interconnection of lightning arrester ground and transformer secondary ground appear to prove its value as one property reports a reduction in transformer burn-outs and fuse blowing to 40 per cent of previous values without any record of high voltage on utilization equipment. The primary advantage consists in limiting the voltage stress between primary and secondary winding of the transformer, and this has been done best by eliminating the transformer case from any of the interconnections or the ground connections. The use of overhead cable for distribution is on the increase.

The use of solderless connectors for joints and line splices continue in favor and offer economies over the use of solder with its attendant costs and hazards. The stud type transformer has found favor on some properties as it is claimed to reduce maintenance and to increase the flashover distance from primary to case and to ground.

Maintenance has become very important in distribution and much activity has occurred in the detection and replacement of deteriorated poles, transformers and accessory devices.

The use of unit substation assemblies and of metal-clad switchgear has increased for use in substations. Greater care has been taken also to improve voltage regulation by a more extensive use of regulators.

Economics of distribution

A greater recognition of the importance of distribution has been gained this year. It is the seat of maximum investment and maximum expense and yet has had relatively little engineering attention. Studies are now under way to fix primary and secondary conductor sizes, transformer and substation sizes, the relative advantages of primary and secondary overhead networks and other aspects of distribution so that excess investment can be eliminated and existing investments be used to better advantage. The aggressive sales programs for selling more load to homes make the present a fruitful opportunity to study and to revamp distribution systems.

News From the Underground System

Cable developments active in mechanical and electrical features.
Stock taking on net work installations.
Cost reductions and service improvements.

MATCHING most other portions of the physical system, the underground elements, cables, ducts, networks, vaults, have been involved but little in installation activity, even for replacements. Reports from many quarters show stripping of utility shelves for parts to help keep old equipment in service. Buying must resume soon as a matter of necessity. Meanwhile the prospective outlays have demanded critical scrutiny of the economic savings possible in the shifting trends. In fact, no department of the business has had more thought devoted to it and more consistent steady evolution toward a goal. A mere cataloguing of the items of discussion and development proves this to be the case. Thus:

Cables—Search for substitute for lead sheath. Synthetic insulations and protectives. Thickness for impulse vs. normal frequency voltages. Preparation of more rigid acceptance tests. Buried types of cable. Analysis of heating and margins of load capacity. Contrasts with European designs and specifications. Deion disconnects for looped feeders.

Networks—Increasing acceptance of primary and secondary networks. Inherent capital waste of conventional substation-radial idea claimed and challenged. Protectors made more positive and reduced in space requirements. New grounding relay developed.

Underground Secondaries—Non-volatile types of insulation devised to control explosion hazard. More watchful studies of voltage regulation on both radial and network-radial systems. Growing attention to skin effect as reducer of capacity.

General Cost Control—Disposition to reopen broad question of need for prevailing high quality of service. Recognition of many factors that will inevitably increase percentage of underground. More general admission that unit costs mean most when expressed in terms of loading rather than capacity. Prompt reclosure of feeders increasingly adopted. Cautious drift to buried cables; ducts seem firmly intrenched. Trend toward resurveying all apparatus ratings; transformers apparently have best chance for revised loading-heating margins of capacity.

Cable sheath failures cause concern

Sheath failures from other than electrolysis and corrosion causes have risen to new prominence and forced two lines of solution. The questions to be answered are, can the lead sheath be made better or must and can there be a substitute? In keeping with the search for synthetic oils and synthetic dielectrics there has been progress in developing synthetic protective coverings for rubber and other insulations for all cable voltages. Interest in the substitute for lead at the moment is apparently greatest for the low-voltage secondary cables, although the inherent weaknesses and advantages of lead for high-voltage cables are equally recognized by both users and producers.

In the latter field it is probably safe to say that the reduced volume of production has had as much to do

with retarded progress in improving the uniformity and elasticity of the lead sheath as anything else. Normal volumes of output would have placed all fabricators in a better position to adopt new machinery, new techniques and finer production control. At least one producer is now using a press which turns out a seamless, weldless lead covering, thus minimizing the faults that rise from seam defects. It has been practically inevitable that impurities and oxides should have got into seams and elsewhere. With revived production these handicaps should disappear. Meanwhile metallurgical studies will be intensified and new processing devised.

It is principally in the 66-kv. solid cable that these mild epidemics of sheath defects have appeared, and this can be viewed as a natural consequence of better impregnation that made dielectric performance better at the expense of relatively lagging progress with the sheath. Cored single-conductor cables of the higher voltages have been relatively immune because these cables have better temperature-pressure resiliency. Incidentally, the insistence of the utilities upon higher operating temperatures here than are employed abroad accentuates the present difficulties. Thicker sheaths may be needed, otherwise, to blanket the impurities that now are sizable with respect to thin sheaths and high internal pressures of solid cables.

Corrosion of cables due to acid- or alkali-laden ground waters is becoming more prevalent. Attention should, therefore, be given to the jointing of the conduits, to the waterproofing of the cement mixture and to general exclusion of ground water from the conduit run.

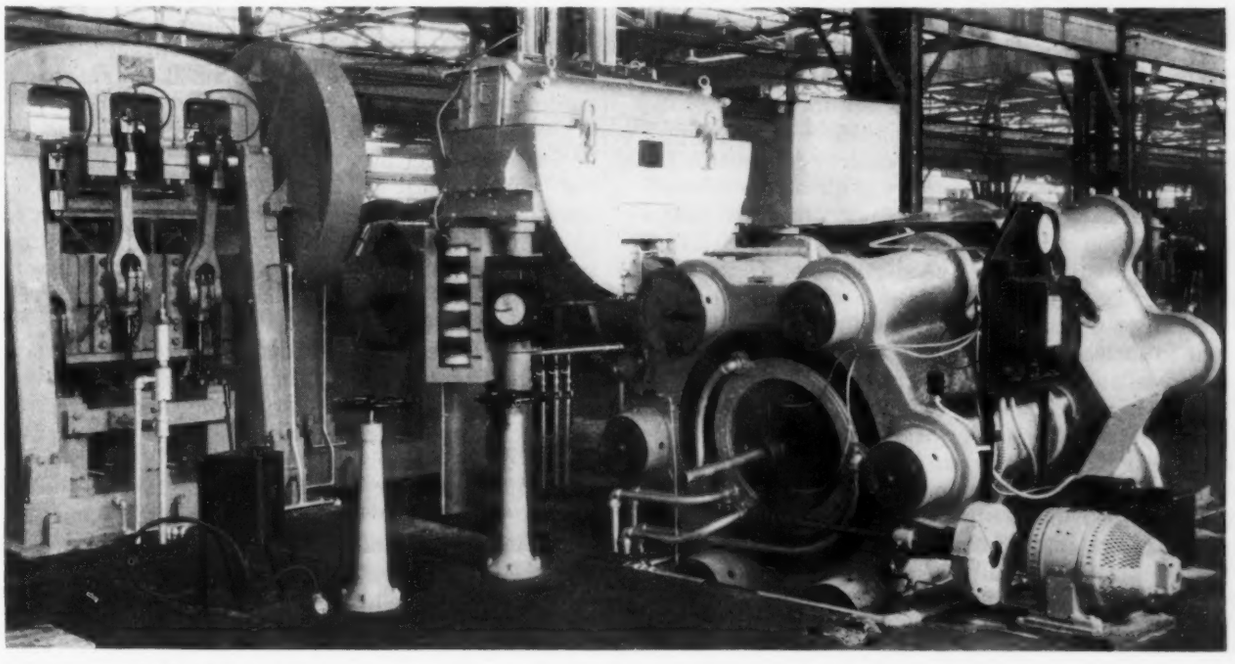
Cable temperature surveys have been found increasingly valuable in controlling loading and hot spots. Here and there an ultimate saving has been made by installing larger sizes of cable or modifying the earth fill around the conduit line to have better radiating properties. Slump of load has in many instances put more burden on cable tie-lines in an effort to release relatively inefficient stations. Usefulness of these ties in the present emergency points to greater future reliance upon cable links as system co-ordinators.

Insulation going synthetic

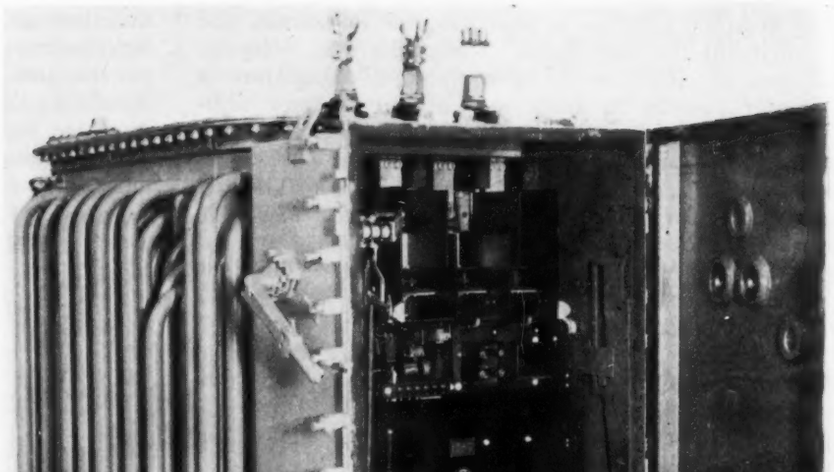
Urging of thinner insulations for higher voltage cables continues to promote research which shifts more and more toward synthetic materials as a substitute for everything but the copper in the cables. Stresses, both electrical, thermal and mechanical, are being edged toward values that are on the point of transcending the ability of simple natural materials to suffice. The trend is steadily toward enunciating the specific properties desired and then synthesizing products that will contribute those properties more definitely than can be obtained by processing available papers, fabrics, varnishes, rubber compounds and oils. Natural organic materials seem to be too temperamental to afford the degree of positiveness that is demanded under such extreme conditions of stress.

Non-migrating insulation is in demand for vertical runs in tall buildings. Cellophane has been suggested, but is not acceptable because of its high power factor, high specific inductive capacity and proneness to tear in tape form. Possibly cellophane could be modified or imitated in such a way as to overcome these defects and at the same time avoid the difficulties of oil and tape under gravity tension.

New rubber compounds age better, stand up better under abrasion and are more resistant to moisture, corona and temperature—all factors that open higher voltages and higher loadings to rubber. In the cambric region similar advances forge into higher voltages as rubber encroaches on the cambric at its lower voltage boundary. Thus Okolite, Thiokol, Glyptal, Gencorone



Straight-through press makes seamless sheath—Watson-Stillman hydraulic lead press at cable mill of General Electric Company. Sheathed cable emerges from rotary member at right. Hydraulic pumps at left and lead kettle in upper center.



Network protector size reduced nearly one-third—Use of non-inflammable cooling and insulating liquid permits large reduction in Westinghouse transformer dimensions. Down, too, must go size of protector built integral with its transformer for vault and network service.

and Pyranol are all evidences of this trend in the lower and medium voltage fields. The future will undoubtedly see their mates in the higher voltage field. In this direction appears to be the greatest hope for controlling ionization, corona deterioration, homogeneity, thermal metabolisms, etc. Meanwhile it will be well to keep in mind that impulse and transient voltages rather than the 60-cycle values are increasingly important as insulation thicknesses are forced down. European thicknesses are in general less than the American. Scott has described a solid English cable for 66 kv. which is evacuated and impregnated with a thin oil after the sheath is applied. Insulation thickness is 570 mils, against the 650 of American practice.

American research on dielectrics has slumped in volume and intensity with the withdrawal of industry subsidies just at the time when it offered the greatest opportunity to tie in with the practical, empirical and laboratory developments of cable producers. For the moment the well-concealed researches of the producers are to be relied upon most for the methodical advances that are taking place in the dielectric art. Even utility research has tapered off, although field studies of cable performance are still being prosecuted so that physical research will be kept near to immediate practical requirements and far enough ahead of them to afford the cautious strides the future will demand.

Present specifications reveal the uniformity of the product and check the manufacturers' production control, but they still lack the vital yardstick which will indicate positively what the life of the cable will be in service. No let-up can be permitted with respect to perfection of accelerated aging tests and of specifications that will give a reliable index of subsequent cable performance in service. In this respect this country is already in advance of Europe, although Europe is admittedly more courageous in experimenting with new cable designs. There are there at least two 220-kv. installations under trial. This country has none and it is doubtful whether load and system set-up conditions are such as to justify commitment to such a doubling of the present upper limit of 132-kv. installations in this country.

The 132-kv. installations in this country have continued to give superior performance. Results are eagerly awaited from the experimental 132-kv. Oil-O-Static installation at Plymouth Junction. This consists of three single-conductor cables without load, laid side by side in a pipe filled with thin oil at 200 lb. pressure. When installed the protective lead sheath is stripped off. A shielding tape surrounds the insulation. Contrasted with this is the Hochstadter and Bowden cable, in which the leaded cable is in a pipe filled with inert gas at high pressure.

After making due allowance for gasoline, illuminating gas and other sources of duct explosions, some degree of possibility of duct and manhole explosions has been attributed to the volatile products in cable insulations such as rubber, paper, tape, etc. Gas and vapor driven off by the destructive action of an arc on low-voltage, heavy-capacity cables, especially networks, are likely to support combustion or make an explosive atmosphere. Substitution of a non-metallic cover for the lead sheath would, in the opinion of some engineers, supported by tests, reduce the likelihood of sustained arcing and so reduce the generation of explosive vapors. Others take the view that a satisfactory degree of safety can only be attained through complete elimination of constituents which may give off explosive gases. One such cable with asbestos as the insulation has been developed during the year and satisfactory results have been obtained in extensive engineering tests.

Omission of the lead as a moisture protection has its appeal in another direction, namely, that of cost. So far the substitution is in the experimental stage for secondary networks. Operating experience is reported to be good, although there has been relatively little publicity so far given to performance. With equality of performance and a sufficiently attractive price differential the abandonment of lead cable for this service would undoubtedly be rapid. Incidental gains to offset any lack of attractive price differential would of course be the complete elimination of joint-wiping costs, electrolysis, metallic corrosion and loss in capacity from induced sheath current heating.

Severe tests have been given to certain of these non-metallic substitutes for the lead sheath. Thus, as one example, to prove the superiority of Thiokol for gasoline, oil and chemical exposure, as well as its resistance to weather, water, and corona deterioration, it has been subjected to sunlight, snow, rain, ice, ozone, ultra-violet

light and corona without evidence of even a surface injury let alone any deterioration of the shell which it constituted around the rubber insulation. As for such soil constituents as acetic acid, this compound is stated to be fifty times as resistant as rubber.

The commonly used cements fall far short of the ideal in fireproofing cables in manholes and around substations. There is a real need for some materials which will be flexible, economical, easily applied and fireproof.

There has possibly been too much assumption that, once properly established, there was little further need of frequent checking of distribution voltages. Some companies which have been diligent about this have found that relatively small changes in loading will shift large blocks of customers across the lower boundary of the zone of permissible voltage variation. By such surveys at peak hours it is determined where money can and should be spent to hold up the service standards, whether by larger secondaries, larger transformers or primary boosting. In some instances it has been found that skin effect had been ignored and that this was an appreciable factor with the large cross-section found in underground secondaries. Segmental sections are the feature of a new conductor aimed at avoiding the loss in capacity and regulation that arises out of skin effect.

Networks meeting enlarged acceptance

Margins of capacity in substations and feeders have become large enough to constitute one of the alibis for doing nothing about starting a network now for the future. The plea of "no money" is another deterrent. But before long the surplus capacity will be absorbed and before that happens a choice will have to be made. Some will find that they can control increments to substation and feeder capacity in the future in such a way as not to create again the large and long-unused increments almost universally installed during the happy expansion days. Some will find that local conditions fail to afford the symmetrical geography and loading that favors the network idea. On the whole, however, it appears that the network idea in some form has won paper converts as well as active commitments to current installation. The network principle is in the first instance a small increment substation idea and will make its progress on that basis. The chief handicap to the network is the relatively light loadings available and the cost and imperfections of the accessory devices.

Advocates and proponents of the networks have had great success in emphasizing the importance of expressing distribution-system unit investment in terms of peak load. Contrasted with investment per unit of installed capacity it brings out forcibly the defect of the substation-radial idea as it has been practiced. The discrepancy is great where zeal to meet big expected increases in load resulted in unduly large stations and large increments to existing stations. When the slump came these marginal capacities stood out, the margin for growth making worse the margin that came with load shrinkage. This lesson has been learned and undoubtedly the big substations and the big margins are not to be repeated.

Meanwhile none of these schemes—modified radial, primary network or secondary network—is afforded many convincing opportunities to prove itself. Buffalo has remained radial in principle in a wholly new installation forced by local circumstances. Generally, however, the revamping of distribution systems is marking time, awaiting the rise of loads that will convert paper studies into actualities of installation. The next wave of construction will clarify the issues by forcing dicisions.

The real point to be observed in this connection is that studies of this character are the peculiar responsibility of the engineer. Even though he may have made mistakes in the past (not infrequently they were initially the mistakes of the overenthusiastic load builder and the executive for whom acme of perfection in service was an obsession), he alone is the one to know best how to capitalize on the advances in technology which squeeze more out of the invested dollar. He should be encouraged to perform his duty in the matter of finding the best and cheapest scheme of distribution that will fit his local situation.

To permit working on the looped 4,800-volt non-conductor cable feeders in the Detroit network area a cubicle type of manually operated Deion disconnect has been developed which is capable of breaking normal load and voltage. Nine have gone into service, being installed in alleys at grade level. The cable loops in and out, terminated by fan-outs insulated with varnished cambric tape, varnish, paragon tape and asphaltum paint.

Concern over cost of distribution

Duct and manhole construction remains an obstinate impediment to reduced costs of underground. Buried cable is available, but still restricted largely to street lighting in parkways and to rural service installations. Reports are eagerly awaited on the continuing success had with the limited cases of this type of installation in suburban and residential areas. Somewhere between the extremes of conventional duct and buried cable seems to lie the field in which revolutionary designing can be looked for. In the meantime the process is a nibbling one as far as economy of the physical installation is concerned. During the year Detroit has made two installations of two-circuit buried cable, 24-kv., three-conductor paper-lead. To protect them against corrosion they were coated with a primer followed by hot bitumastic enamel. A flat-spout sprinkler can was used and the coating was wiped onto the bottom side by means of a corona sling. U-shaped vitrified tile was inverted over the cables to afford mechanical protection.

The most tangible progress is being made in connection with the purely electrical aspects of distribution systems. Debate continues over the relative merits of radial and networked schemes. Back of all this is lurking the question as to the degree of service reliability to be adopted as a guide to system expenditure. Studies of customer outage hours are being made on an enlarged scale to throw light on this matter. Out of these will come a more definite assessment of the increments of capital, operating and maintenance costs that go with the provision of successively higher degrees of service reliability.

Congested metropolitan areas demand superlative service, but fringe areas are content with less. It is an engineering-economic problem to fix degrees of service reliability in keeping with what each area presents as to load importance, public relations and outage restoration costs. With these evaluated, the permissible outlay for corresponding service reliability can be stated. Mixed in with this problem is that of a possible rerating of items of equipment so that each will be assessed more truly at

its economical loading potentiality. By this means the prevailing margins of load capacity in distribution, expressed in nominal terms, will undoubtedly be revised upward slightly and thus postpone for a slightly longer period the day when new equipment will become imperative. This pertains to ties and station-to-station transfers in so far as these are part of the underground system more than to the bulk distribution system as such.

One not wholly minor matter of economy would be the salvaging of pulled cable to a far greater extent than is now the practice. Development in Detroit of a duct-splice for cables up to 24 kv. (3-conductor shielded paper-lead) is one step toward the possibility of establishing a comprehensive cable salvaging plant. Every foot of pulled cable could be tested, inspected, repaired, duct-spliced and retested in reassembled lengths. Cost would undoubtedly be heavy, but the salvage value would be correspondingly large and might easily pay the cost of the salvage plant quickly. Accelerated life tests would have to be even more certain than for new cable.

Progress With Meters

Standardization program receives new impetus.

Demand meters getting renewed attention.

Lighting given a boost by new meters.

AWAKENED interest in service metering has been stimulated by a realization that prevention of energy diversion and reduced costs of meter installation and administration should both be made possible without further delay. As pointed out in last week's issue, the energy metering art has forged ahead by zigzag strides, the latest completed one being the improvement of internal electrical performance of watt-hour meters. That progress was national in scope because all producers and users participated in it. Among the advances were better light and heavy load accuracy, better temperature and power-factor performance, lower starting loads and generally simplified ratings and constants. Features that aimed squarely at preventing tampering have, however, until very recently received more a local than a national solution. Every factor in the industry has meanwhile been contributing elements toward solving the problem—box manufacturers, seal makers, meter departments and meter manufacturers.

During the past year there has been a determined effort to reduce the number and variety of solutions that evolved from the previous attempts and thus converge toward as nearly as possible a universal solution. Industry committees have been spurred to a critical study of the broader aspects of the problem, not only as it affects the meter department but as it affects the accounting, distribution and public relations.

Meanwhile intensive effort on the part of manufacturers has resulted in presenting designs that go far in incorporating what seems to be the protective features demanded by a shifting moral attitude on the part of many consumers. These designs are now before the industry for consideration in its individual and collective aspects. Interchangeability between different components of the protective scheme, including the meter itself as well as the accessory test and inclosure elements, is foremost among the desirable attributes of what is wanted and what is offered. With that as an established fact, the inevitable replacement program of meters acknowledged to be obsolete as to internal and external characteristics can then proceed with assurance that the present lack of uniformity will give way to a future régime that will mean long-range economies and freedom from distressing experience in meter administration.

One scheme announced several months ago involves a detachable form of meter with armored mounting that is adaptable alike to indoor or outdoor installation. The design holds appeal for those who see economic virtue in coverting large stocks of meters now in service. More recently a joint design of other manufacturers presents a group of three elements—meter, connection block, inclosure—which can be interchangeably assembled to attain progressive degrees of protection as well as complete accessibility for testing whether the installation be indoors or outdoors.

Too many local designs of meter protection

In all this there has been a growing recognition of the timeliness of doing something now about meter installation. Costs of meters enhanced by those incurred with adequate meter installation facilities can undoubtedly be reduced along with other parts of the utility property. But no great progress along these lines can be made until the great multiplicity of specialized installation designs give way to a single group of solutions. The manufacturers have taken a courageous lead on this during the year and the meter purchasers will surely derive direct and indirect benefits as soon as the designs can move into quantity production and consumption. This can hardly happen, however, until there is more of a disposition on the part of each utility to accept a compromise composite as a substitute for what it may have developed in the previous absence of anything approaching a standard. This spirit is now being manifested under the stimulus given by the year's contributions from the producers' side of the fence. Another year will undoubtedly see recognition of the fact that progress is being made in such manner as to justify large scale replacement of obsolete watt-hour meters with a minimum of outlay and of write-off.

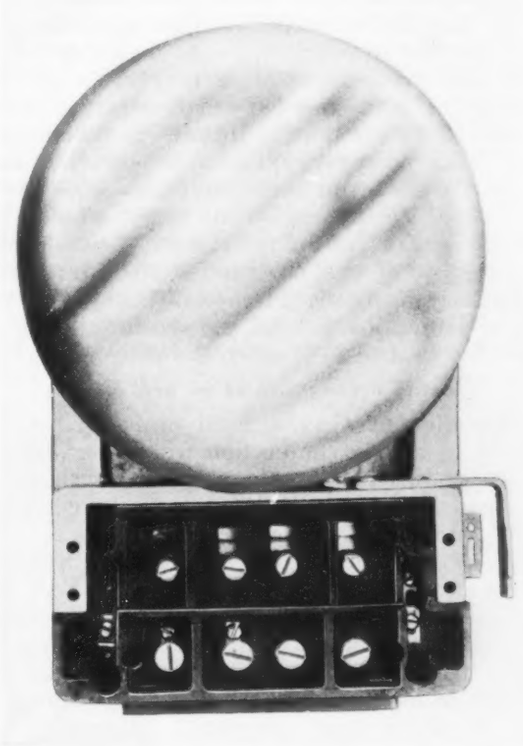
Any utility area that is not hamstrung by low consumer income or by inadequate wiring deserves meters that will respond accurately to the heavy appliance loads and the light clock loads which are and will be characteristic of such areas. Any meter with less extended accuracy is obsolete wherever loads are sure to move into heavier brackets in response to load-building activity. So, also, for the electrically backward areas is a meter

obsolete unless it can be adapted to new sequence, outdoor installation, inclosure or other adequate protection against the tampering that is more common there than elsewhere.

"New sequence" benefits now being derived

Incidentally, this movement of replacement will carry with it a fuller realization of the benefits of the new sequence permitted by a liberalized National Electrical Code. So far, this sanction of meter-switch-fuse applies only up to 100 amp. main switches on 150-volt-to-ground circuits. There is good reason on the utility side for urging that the current transformers used on larger currents than 100 amp. have higher insulation than the meter itself and that safety considerations are therefore not furthered by having any upper limit whatever set to circuit currents with resort to the new sequence.

Meters have been going outdoors, but there has been no wholesale movement of national proportions. Theft and seasonal accessibility are the determining factors as far as the shift of household meters is concerned. Epidemics of diversion in certain districts have forced some utilities to move all meters in the district outdoors even though not all were tampered with. One deterrent to outdoor installation has always been doubt about the resistance of the meter and box to the weather. Many so-called non-rust materials failed to live up to their claims and must be replaced as too unsightly to continue on the outside of consumers' homes; more general use of die-cast aluminum as the exposed metal seems to be one logical answer that would avert that kind of grief.



Interchangeability features units of new joint design—Conventional house meter with safety disconnect and test facilities interchangeable among meters of three manufacturers.

Detachable meter one of year's developments—As here shown the socket principle is used in conjunction with junction block, test facilities and box inclosure.

Several utilities have worked out methods of testing the insulation of meters and metering equipment. In the larger centers high voltage can be employed with considerable safety. However, in the smaller departments there is more chance for trouble. Hence several utilities have worked out insulation-testing devices which do not involve high voltage. There is a real field for such equipment to meet the greater importance of adequate meter insulation as the new sequence comes more and more into vogue.

Phantom-load field testing is yielding to resistor loading, especially in the case of three-wire meters, where it affords the greater time saving. New switching devices avoid the necessity of changing connections in proceeding from light to full load test. For the larger companies the tests in the meter shop have become largely automatic, stroboscopic and photo-cell timing having proved an advance for multiple testing.

There is a growing tendency to pin permanence of meter accuracy largely to the jewel; there is talk of the "twenty-year" jewel. More exhaustive tests are a consequence with both manufacturers and meter buyers. Neither the natural nor the synthetic sapphire has as yet won a clear majority of adherents under the closer scrutiny to which all jewels are being subjected.

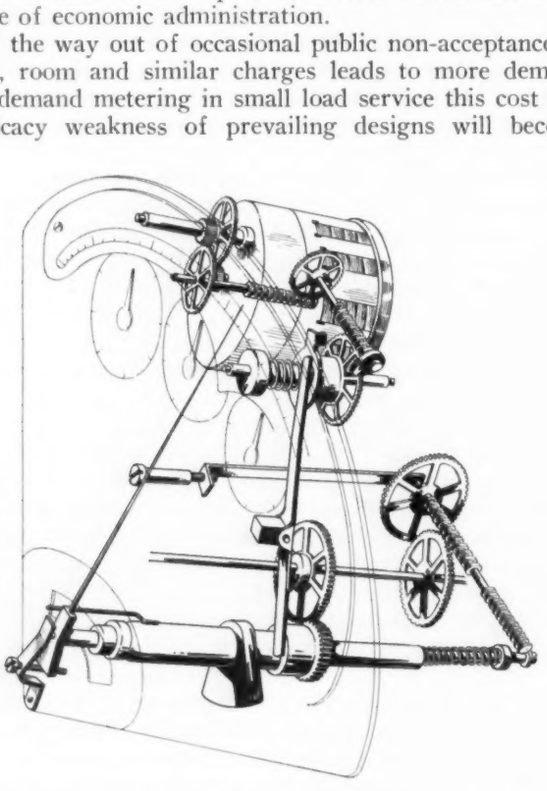
With all the recent advance in accuracy and permanence of the watt-hour meter there has naturally been a movement, steadily successful, to have the periodic test interval lengthened. As the percentage of modern meters with improved all-round characteristics is increased this period could still further be lengthened; seven years is not too long an interval between tests as indicated by the records of several companies. As long as diversion remains a problem there is doubt, however, in some quarters whether the present frequency of tests should not be retained as a potent form of inspection.

Paralleling the advance in characteristics of instrument transformers (phase angle, ratio, insulation, weight, connection facilities) there has come better grounding practice, improved test devices to minimize the possibility of opening current transformer secondaries under load, and sealed isolation of otherwise exposed live parts. Nevertheless primary metering of customer loads involves potentially inherent hazards to meter testers and it contributes either to metering interruptions or loss of service due to occasional failures of the relatively vulnerable metering transformers. To offset this and to derive some cost differential at the same time one large company is engaging extensively in metering wholly on the secondary side by a "compensating metering" installation.

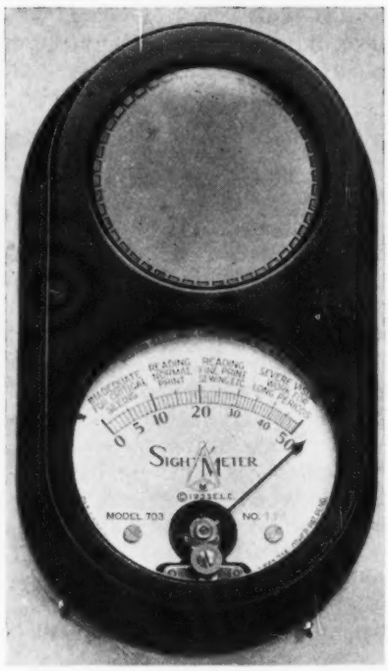
A conventional meter measures the actual input to the customer. An additional modified polyphase meter with combined voltage and current-squared elements is adjusted to measure the iron and copper losses of the customer's service transformers along with any added line losses that should be included under primary metering. In some cases higher accuracy is attainable than with primary metering.

There is considerable disaffection with demand metering prospects. No one seems to have hit upon a mechanism that equals the watt-hour meter itself in simplicity of parts, simplicity of characteristics, simplicity of principle and simplicity of testing. For thousands of demand meters now giving acceptable service on large loads, the absence of one or more of these attributes is not a fatal defect. But the growing number of medium-sized loads that call for demand measurement leaves much to be desired in present devices viewed from the angle of economic administration.

If the way out of occasional public non-acceptance of area, room and similar charges leads to more demand for demand metering in small load service this cost and intricacy weakness of prevailing designs will become critical. This disaffection has not escaped the manufacturers' notice. At least one new design has appeared this year and others are expected to be announced shortly. Immediate progress is being made in getting more ruggedness and positiveness as an adjunct of accuracy. Cyclometer cumulative dials have come on the market to facilitate checking of inaccurate demand readings previously obliterated upon reset. They tend to penalize efforts to reduce demand indications by pushing the indicating pointer below its actual maximum; any such tampering adds to the demand registered at the next reading. Totalizing of multiple demands is on an improved plane.



Simplicity marks new Retlau demand meter—Synchronous motor actuates semi-cone clutch on sweep-hand shaft at beginning and end of demand interval.



Self-contained sight meter proves aid to better lighting

Graphic recording instruments are attracting more attention in industrial circles just because of the ready way in which they throw inexpensive light upon the reasons for interrupted production, high maintenance costs, stresses and losses incurred in duty cycle operations, inefficiency of production-line performance of men and machines. They are proving themselves to be more and more a check upon personnel, capital outlays, management and the efficacy of automatic control equipment.

Typical of instruments that verge off into non-electrical channels are the following new developments: X-ray detection of weld flaws and of voids in compound-filled bushings, magnetic detection of seam-weld flaws in steel tube fabrication, Selsyns and synchro-ties for speed and tension control in sheet-steel rolling mills.

Better lighting boosted by new meter

Telemetering has had a rapid evolution both independently of and in conjunction with supervisory control. It was inevitable that some systems should have been devised that relied upon relatively cumbersome ways of adjusting the telemetered currents to proportionality with the telemetered quantity at the transmitter. Vacuum tubes and photo-cells have recently been substituted for some of the previous relay-actuated devices.

Raising the commercial and industrial levels of illumination has been given a great spurt by the advent of a light meter that gives direct and convincing indication of illumination adequacy. Especially in its simplest "sight-meter" form it hits the user of space illumination in a way that none of the past technique of room indexes, wall coefficients and recommended levels has ever done.

Electrical Developments in Industry

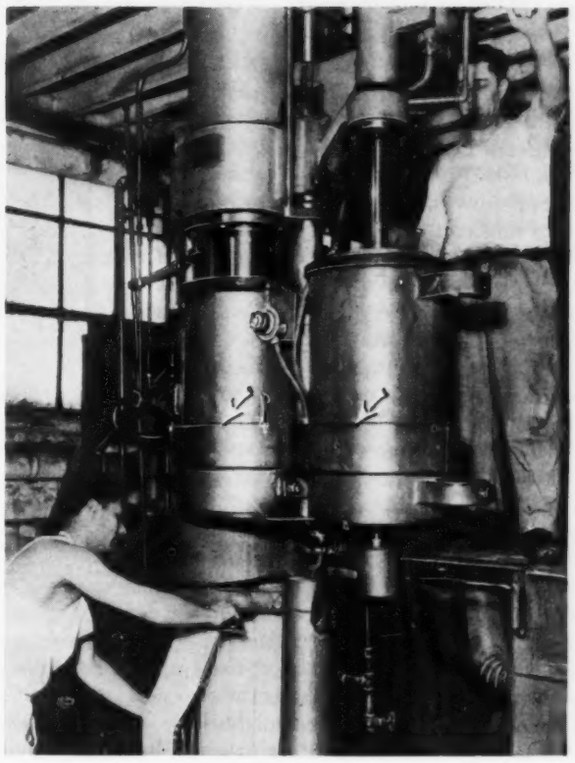
Obsolescence requires replacement by electrification.
Many new products and processes available.
Typical new applications outlined.
Electrochemical and electric heat dominant influences.

ONE of the largest but most difficult markets for electrical products and services is in industry. It is well known that business revival depends upon a recovery in capital goods industries and efforts are strenuous to bring this about. This market, however, is largely a rehabilitation market and must be sold by replacing obsolete equipment and processes with new and modern devices and methods. Very largely this means a greater measure of electrification. The handicap to sales lies in the reluctance of industry to make long-term investments because of low business volume and unsettled monetary conditions. A second element is the expense and time involved in getting data whereby replacement sales may be justified. On the other hand, competition under the codes depends upon low cost production and this gives an impetus to industrial selling.

Technological progress in electrical devices and services for industry has been rapid during the year. Old apparatus has been improved, new apparatus has been produced and new processes and methods involving electrification have been developed. It is estimated that 60 per cent of industrial equipment and processes is obsolete, and this fact, together with the new industries developed and the unsold market in industry, affords an enormous market for the electrical industry. The following outline of technical developments, new equipment and process improvements show some tangible approaches to this great possibility for business expansion.

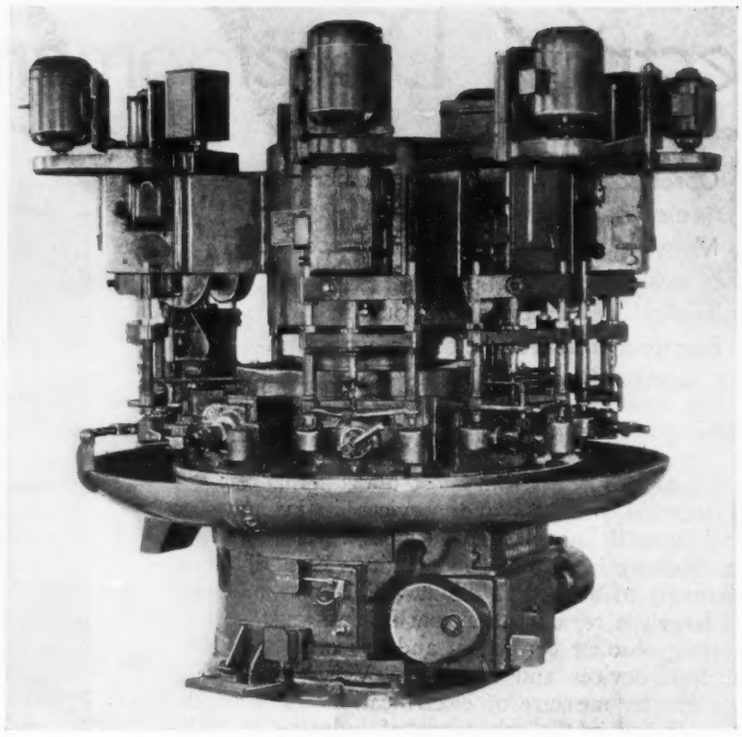
Inclosed and Geared Motors Favored—The geared motor is not new, but its reception in industry has come largely this year. It has proved its compactness and high efficiency and has alleviated tense situations that used to arise out of the divided responsibility when the torque and speed were assigned separately to motor and to gear box for accomplishment. Nine-tenths of industrial loads call for speeds less than the 1,800, which is so propitious for a large percentage of the motors. Any motor, d.c. or a.c., vertical or horizontal, inclosed or open, can now be obtained in the single-stage integrated-gear design for ratios up to about 12½ to 1, above which the box is changed to house compound gearing.

Gear-head motors in which reduction gears of various ratios are accommodated in the head of relatively high-speed motors have simplified the application of motors to various industrial processes which operate at low speeds. The efficiencies and compactness of the higher speed motors (1,800 or 3,600 r.p.m.) are obtained; the combined gear head and motor are very small; the machine builder doesn't have to provide complex gearing to adapt the machine to standard motors, and because one or two speed ratings can take care of most all drives, motor manufacturers and users do not have to stock so many different motors, with consequent saving and ultimate reduction in price.



Wherever heat is needed for scattered industrial processes, it can be applied by immersion, clamp-on or cartridge-type electric units without bothering about steam lines or worrying about open flames.

The year has seen a pronounced drift toward the inclosed motor. The motor is being taken to its job wherever it may be and whatever the surroundings may afford as to cleanliness and dryness. All three forms of inclosure have met with increasing acceptance. The splash-proof and weatherproof design is doing the wet-interior and the outdoor job, often simplifying the design of the production system by avoiding the necessity of an expensive housing for the equipment where exposed to leakage, splashing and dripping from wet processes. Local dirty atmospheres are apparently inevitable in some industries, and for these the trend has been very strong toward the double-shell, fan-cooled type of motor. Insurance pressure, excited by premium differentials, has given a new impetus to the explosion-proof motor. The reduced maintenance costs attending



Machine-tool builders are recognizing motors and electrical control as integral parts of machine tools and making them such, increasing flexibility of operation, reducing unproductive time, permitting machines to be shifted as flow of products dictate and eliminating complicated mechanical drives and controls

the adoption of all three of these forms has been a strong factor inducing their more general adoption.

Machine-Tool Drives—Machine-tool builders show a decided trend to built-in motors and controls and the substitution of electric controls for the more complicated or less satisfactory mechanical controls. Many operations on machines are being individually driven, where their starting, running or reversing requirements differ and would require complex mechanical arrangements and devices if single motors were used for the entire machine or a group of operations. Some of the advantages are to simplify the control, permit more control to be automatic, allow interlocking of operations, avoid delays in finding space for and installing motors and control, simplify wiring, protect motors and controls from exposure to bad operating conditions and reduce the unproductive time in machine operation.

One prominent machine tool builder has said that the motor drive and control constitute the heart of machine tools and that instead of considering them as afterthoughts, they should be considered in the preliminary design of machines so they will be properly adapted to the machine and so the machine will be adapted to them. This requires close co-operation of machine tool builder and electrical manufacturer. There is a growing tendency to make the electrical engineer a more important factor in machine-tool design—one who will suggest possibilities with electrical apparatus, rather than one who merely tries to adapt existing equipment to the requests of a mechanical designer.

Individual Drive for Industrial Equipment—Individual motor drive has all the advantages it ever did, and will probably always be the most flexible because each motor and its control is specifically adapted to the operation it serves, and the motors and control can be made an integral part of the machine. With individual motors outages affect single operations instead of groups, no power is used when any individual operation is stopped and the machines can be easily regrouped for most efficient processing with changed production.

However, the semi-group drive is attracting interest again because many of the components have been greatly improved in recent years, removing many of the disadvantages of the group drives of former years. These improvements include non-friction bearings, a variety of compact speed reduction, transmission, clutching and coupling units. Aside from these improvements, the driving of fewer units in groups removes some of the disadvantages associated with old group drives and gains advantages over the costs of buying individual motors and operating them at lower use factors and load factors. Undoubtedly individual drive was overdone and all drives are now being checked upon a better economic and engineering basis.

Avoiding Motor Outages on Voltage Dips—Studies by one utility engineer indicate that nearly 80 per cent of motor outages in industrial plants are due to voltage dips and instantaneous low-voltage releases. By applying time delay to the low-voltage releases most motors can be made to ride through severe momentary voltage dips or two-second dips of less magnitude. In some processes imperfection may result in product by temporary slow down and restoration of normal speed, but many industrials have found this disadvantage less than that of a complete shut-down and the trouble of starting up again. In some cases the delay in dropping out on low voltage can be effected by connecting the instantaneous low-voltage release to pilot generators connected to the driven machine.

Automatic Field Application—Automatic application of field current to synchronous motors when they approach a synchronizing speed and automatic removal thereof when the unit drops out of synchronism is now possible. In the first case, rectified slip-current from the rotor circuit is used to close the field, dependence being placed on a time-delay relay which will close only when the duration of a rectified rotor current wave is relatively long; *i.e.*, when slip is very small. Opening of the field circuit is effected by a relay actuated by the marked reduction in power factor which occurs when a synchronous motor slips poles in dropping out of synchronism.

Protection of Squirrel-Cage Windings—In synchronous motors this is not afforded by the same equipment

which protects the stator winding as the rate of temperature rise of the amortisseur may be nearly three times that of the stator when a motor is stalled and remains greater until nearly 80 per cent of synchronous speed is reached. By connecting a reactor and thermostat-controlled relay in parallel across the squirrel-cage winding the motor can be disconnected by the increased slip-frequency at any desired sub-synchronous speed. Near synchronous speeds (low slip frequency) the reactor diverts most of the current from the thermostat relay. At low speeds (higher slip frequency) the impedance of the reactor diverts more current through the relay.

Leniency on Starting Currents—More leniency in allowable starting currents is being shown by some utilities, which are based on the capacity of the distribution system to take sudden loads without objectionable voltage fluctuations. Previously one company limited the starting current of any motor to 200 amp. increments per half second and the installation of squirrel-cage motors larger than 50 hp. was not permitted. Now motors of 15 hp. or less meeting N.E.L.A. requirements may be connected without any starting equipment on the overhead lines and 5 hp. or less on the underground lines. All motors larger than these two sizes are considered separately and investigations made to determine what starting currents can be allowed without objectionable effects.

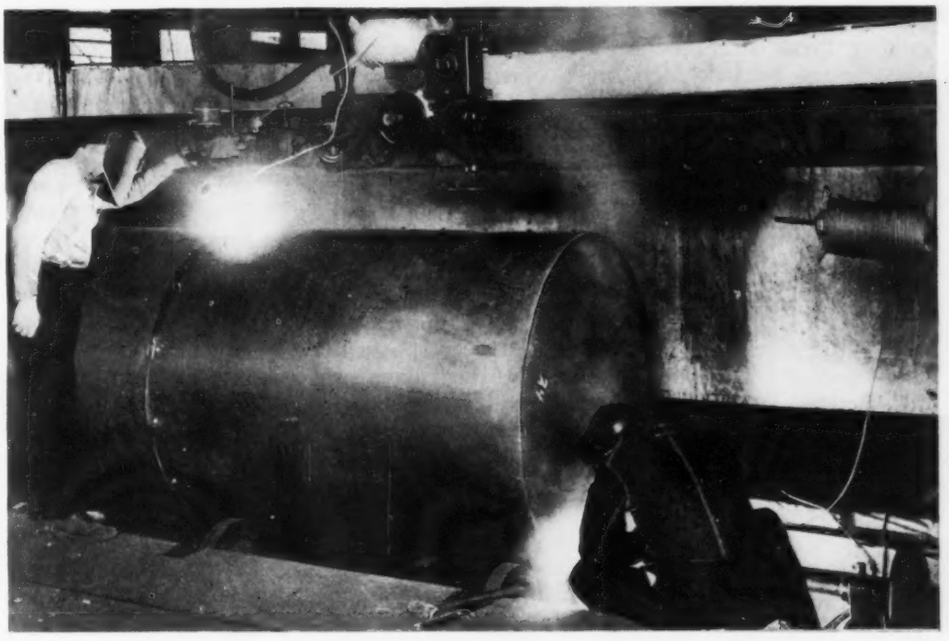
Steel Mill Uses Air Conditioning—Air conditioning is used in at least one steel mill for cooling the air ventilating roll motors and motor-generators. This was necessary because of the concentration of units which released about 20 per cent of their rating into the air as heat and to avoid the operating troubles caused by the presence of acid fume, soot, scale, etc., in the air. Various schemes were tried, including taking all air from outdoors through oil screens and paper mats, and combining with air coolers. The final plan was to force air up through roll motors and then down through adjacent motor-generators into the basement, where an air cooler completed the closed-circuit system. Provision is made for taking make-up air from outdoors through air-filter louvers.

New Control Developments—Similar in trend and in causes for the trend in the case of the motor is the control for it. The control has been following its motor to the job and therefore taking on the design features which make it either weatherproof or oil immersed or explosion-proof. The enlarged use of the latter has come very prominently into vogue with oil refineries, especially those which choose to carry their own insurance. Among the explosion-proof devices is a "start-stop" push-button station with inclosed case and oil-immersed contacts and connections. Oil-immersed inclosed magnetic switches have also been developed.

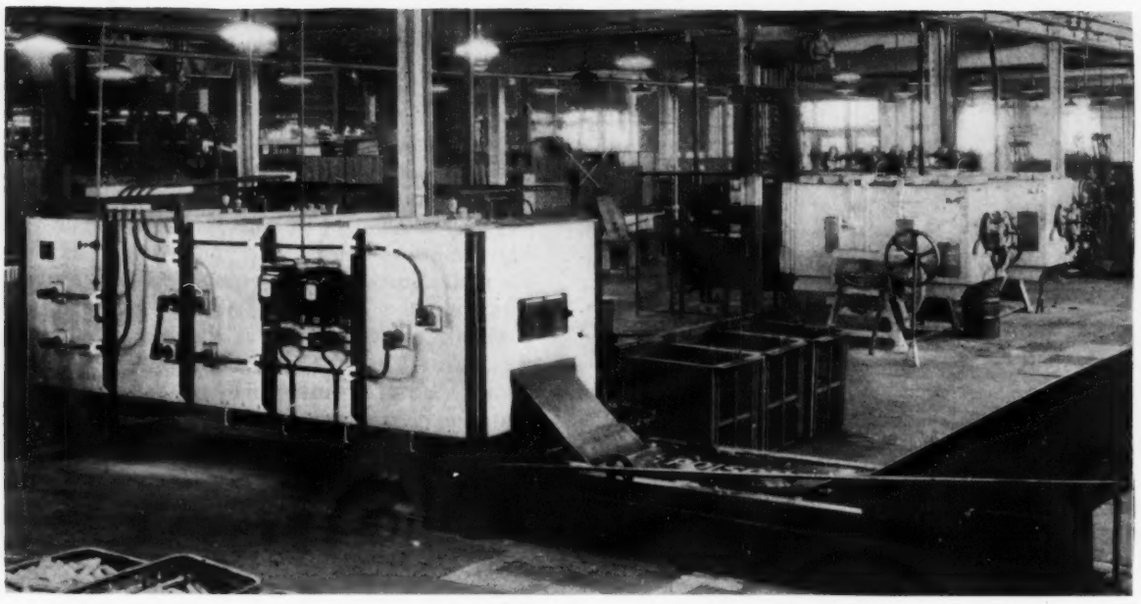
Tension Control in Sheet Rolling—The trick in rolling the wider sheets flat and straight as demanded by the metal furniture and automotive industries lies in tension control. Front and back tension either side of each pass takes power (half as much as applied to the rolls themselves) to the extent of a ton for each inch of width. Controls involve intricate balance of successive motor excitations so as to graduate the requisite speeds and torques for rolling and for tension. Regenerative braking is also applied at the reel motor in strip rolling to control tension in connection with the increasing adoption of the single-roll stand with two tension reels.

Sheet Gaging and Screw-down—Accuracy of ¼ mil in sheet rolling is possible with a new electric gage developed jointly by electrical and machine tool manufacturers to effect continuous gaging of steel strip. It can be interlocked with the automatic screw-down mechanism to readjust it in case tolerances have been exceeded. It gives a response proportional to strip thickness.

Greater speed and accuracy in rolling steel has been made possible by control which permits establishing a rolling schedule in advance (that is, determining the number of passes and reduction for each one), presetting the control for these operations and then merely pressing a button after each pass. In one form the schedule is set up on screw-down limit switches, there being a lever for each pass. After the pass is made a touch of the button starts the screw-down motor which is stopped by the limit switch. Another form of pre-set screw-down control devised for a mill operating on a widely varying schedule of ingot sizes involves an elaborate plug-board.



Industrial fabrication is being revolutionized and expedited by electric welding. On repetitive operations it can be automatically controlled so uniformity of results are secured



Electric ovens and furnaces can be placed exactly where needed without the difficulties of fuel delivery or removal of products of combustion involved in fuel-fired units. Accuracy of control assures quality production with minimum loss due to rejects.

Reversible Tin-Plate Mill—The plate is drawn from one reel and fed through rolls onto wind-up reel and the process reversed several times until the plate is reduced to desired thickness. Each reel and the rolls are driven by separate motors. The strip must be held under heavy tension, sometimes as much as 40,000 lb., by both reels as it goes through the mill, so the motor on the reels from which the strip is being drawn must act as a regenerative brake, but automatically change to a motor when the reel performs the take-up function. Furthermore, the tension must be automatically maintained constant by both reels regardless of linear speed of the strip and the diameter of the coil.

Sheet Catcher for Mills—The back-breaking job of catching a pack of sheets issuing from rolls in tongs and guiding them back into the rolls again has been made unnecessary by machinery and control. As the pack comes through the mill it slides onto the catcher table and is pulled back by a conveyor chain. When the end leaves the mill an electric eye simultaneously tilts the table and reverses the chain so the sheets are fed back into the next set of rolls. Each round trip of the pack takes a little more than three seconds, requiring that the motor start, reverse and stop once each cycle.

Tube Control—A positive trend toward use of thermionic tubes in motor and heat control has marked the year. By no means has it all been accomplished by photo-electric tubes alone. Processes which have profited by this advance are, for example, wire drawing, continuous strip and sheet steel, cord-tire fabrication, conveyor synchronization, etc.

In the mill of the Cherry River Paper Company the direct-current motor driving the variable-speed line shaft on a paper machine is kept at a constant value by an electronic regulator. This regulator, which is essentially a voltage regulator, operates to maintain constant voltage on a pilot generator driven by the machine line shaft. The voltage of this generator is balanced against a small battery and any deviation from a balance operates through the tube circuit and an exciter to vary the armature voltage of the main generator and restore balance of speed and pilot voltage. A rheostat in series with the regulator and pilot generator can be used to make the regulator raise the voltage and increase the motor speed.

Balancing Material Input and Output—The flow of raw materials from twenty storage bins containing seven kinds of material had to be proportioned and synchronized with the total discharge of the resulting mixture into processing machines. The flow from each bin was controlled by the speed of a feeder table under each bin, discharging onto a conveyor receiving material from all feeder tables. All the storage feeder table motors are fed by an alternator driven by a Ward-Leonard set, so that after the feed to each table is proportioned with respect to the total mixture, the same relative proportions can be maintained for varying demands at the processing tables by adjusting the d.c. voltage on the Ward-Leonard generator. This is accomplished automatically by a balanced relay, one coil of which is connected to a tachometer generator on the process-machine feeder table drive, and the other coil to a similar generator on the alternator shaft. The contacts of the balanced relay are connected to turn the motor-operated rheostat on the Ward-Leonard generator in the direction which will bring the speed of the alternator (which determines the composite feed from the storage bins) into harmony with the speed of the process feeder tables.

Moisture Content in Paper-Web—Paper emerging from the drying rolls of a paper machine can be accurately checked for moisture by letting the moving web serve as the dielectric in a special condenser forming one arm of a capacitance bridge and using a zero-center meter to indicate departures of web-condenser displacement current from that of a standard comparator condenser. So variations in thickness of the web will have no practical effect, both plates of the condenser are placed on the same side of the web. Actually the condenser has 132 pairs of plates in parallel, made by drilling as many holes in a metal plate in which are inserted,

but insulated from it, 132 metal plugs connected in parallel to form one side of the condenser while the surrounding plate serves as the other side.

Relay-Controlled Billet Spray—A high-pressure water spray is customarily employed to remove displaced scale from billets during rolling, but as it tends to cool the ends too much an attendant must turn off the spray as the ends pass. To eliminate this attention a relay-controlled spray was recently installed in the Inland Steel Company's plant. The oncoming slab strikes a limit switch which energizes a time-delay relay that turns on the spray just behind the advancing end. When the end of the billet releases the limit switch another timing relay comes into action which shuts off the spray just before the trailing end approaches.

Industrial Heat Applications—More money has been spent on furnace development during the past three years than ever before. The extensive resort to controlled atmospheres in conjunction with electric furnaces has greatly enhanced their supremacy over fuel-fired furnaces for many processes. The real problem has been to bring down the cost of the atmospheric materials. Cracking of city gases with steam added still further to break down the hydrocarbons has been one means of cutting the cost to half that of the original gas. This process does, however, still entail expensive equipment. Dissociation of ammonia gas has also moved toward higher success. The combustion type in which gas is burned in a deficiency of air to create a mixture of carbon dioxide and carbon monoxide has been another contribution. As a result of these three principal approaches a remarkable spurt has been given to the controlled atmosphere furnace. In fact, it represents a dominating portion of all the electric furnace business. Bright annealing of cold-rolled strip, copper annealing and brazing of steel parts with the atmosphere providing the requisite flux agency have forged ahead.

Small Industrial Heating Units—This business has not slumped at all. The way is being found to ferret out the small isolated process plant that can use electric heat profitably in small magnitude processes. One drawback has been the relatively high cost of the thermostat that is almost always needed to make the control ideal. Another obstacle is the frequent necessity of redesigning the kettle, press, etc., so that electric heat can be adopted. Neither the industrial plant, the sympathetic utility nor the best salesman can do this, in general, and it seems that factory service bureaus similar to those for motor maintenance will be needed more extensively to open up this market for heat in industrial plants.

Cast Iron Comes Back—Heat treatment of cast iron in the molten state is practicable only in the electric furnaces. What has been accomplished in this respect has restored cast iron to its wonted share of iron fabrication. The shift to steel and to alloys has been reversed and steel now looks to welding as the means to resume its ascendency. Automotive crankshafts of the forged type are giving way again to cast iron because of the superlative grain quality that can be imparted by controlled electric melt and by reduced amount of subsequent heat treatment. Pressure vessels are again being made of cast iron. The trend really amounts to the substitution of kilowatt-hour dollars for those previously spent for high-priced metals and alloys.

Five foundries served by Detroit Edison use ten electric furnaces (totaling 4,650 kw.) for cast-iron production and five units for experimental work. Electric cast iron is being used for automobile camshafts, cylinder blocks, manifolds, tappets, clutch plates, brake drums and replacing steel forgings and steel and malleable iron castings. It is also being considered for automobile crankshafts.

On the basis of producing 2,500,000 cars per year and 500 lb. of castings per car, the automobile industry alone would require 625,000 tons of castings per year. This would require 893,000 tons of molten iron in the foundries. If 580,000 tons were duplexed and 313,000 tons cold melted from scrap the potential energy consumption would be 245,000,000 kw.-hr. In addition many electric castings would be heat treated. By proper melting and heat treating electric cast iron can be produced with tensile values that exceed 100,000 lb. per square inch.

Alloy Steels—The induction furnace is holding its place in this field of activity. Stainless steel scrap is readily reclaimed in the induction furnace, many plants with such furnaces having been kept busy supplying the increasing market demand for alloy casting. Several new and larger capacity furnaces have been installed.

Low-Frequency Oven—Such an oven operating at 360 cycles is used for baking enamel on fenders, etc., in the Plymouth plant. Among advantages claimed by the user are: Heat is produced only where needed; drying takes place from metal outward, giving a denser coat free from holes and wrinkles; so much power is not required because the surrounding air does not have to be heated (75-85 deg. F. lower than metal), consequently air carrying off volatiles does not remove so much heat; oven walls radiate less heat because of lower temperature of air within. The power cost at 0.9 cents per kilowatt-hour amounts to 78 cents and 39.4 cents per ton for baking the primer and color coats, respectively, or $1.17 per ton of finished product.

Welding Grows in Favor—For several years industry has been using electric welding to advantage. It first gained a foothold in rough fabrication so that welded sheet steel could replace castings. It next entered more refined fabrication realms and this introduced coated electrodes, automatic welding machines and special processing for welding different kinds of metals. Welding now is an accepted process for all kinds of industrial fabrication and the past year witnessed a growth in the business, an extension of the process and an improvement in the equipment and methods.

The shear and tension values of spot welds are very definite and uniform, says G. S. Hughes, Truscon Steel Company, if the thickness of steel, diameter of electrodes, pressure, time of welding and capacity of welder are fixed. With automatic welders both the pressure and time of welding can be definitely fixed, the electronic timer utilizing the charging time of a condenser giving definite and controllable values. Shear tests on automatically made flash and spot welds conducted by Mr. Hughes show average unit values equal to 94 to 99 per cent of the parent metal, while minimum shear values obtained were 92 to 97.5 per cent of minimum parent metal shear values, the spot-weld shear values being slightly lower than the flash-weld values.

Welding of galvanized steel is quite practical. Cast steel containing 0.28 per cent C, 0.86 per cent Mn and 0.47 per cent Si can be successfully welded to cast steel or hot-rolled low-carbon steel with either bare or fluxed electrodes. Butt welds of structural nickel-steel are being made with coated electrodes by the Watertown Arsenal. Stainless steel can be either spot welded or line welded without losing corrosion-resisting characteristics and without subsequent treatment by accurate timing of the duration of current. Snug-fit joints of iron or steel are being welded (or brazed) by applying copper wire or copper paste adjacent to joint and heating in controlled-atmosphere electric furnaces to 2,100 deg. F. until the copper is melted and drawn by capillary action into the seam, where it forms an alloy with iron.

Electrochemical Uses Growing—Within the last ten years there has been an increase of almost 200 per cent in electrochemical products—10,000,000 tons today—says Colin G. Fink, who believes extension of electrochemical processes and adoption of new ones may make electrochemical uses of electricity dominate power requirements of industry some day. The processes involve fusing of a variety of electrolytes, recovery of products from aqueous electrolytes, electroplating, alkali and chlorine production and electric furnaces and products. A new method of copper plating steel in what is called an oxalato bath (cyanide-free) produces a sufficient thickness of copper in less time than with a cyanide bath and with lower current density. A current density of 10 amp. per square foot and a plating period of 60 seconds is considered most satisfactory. One steel company is using 4,000 amp. at 66 volts in an alkaline solution to effect rapid cleaning of steel strip.

Industrial Instrumentation—Industry still lags far behind in profiting by the use of electric meters for emergency testing, for periodic surveys of plant reliability and performance and for continuous recording of activities, interruptions and economies. These are accepted when they are incorporated by the manufacturer as an inherent component of control panels, but the equal virtue of independent instrument units continues to go unrecognized or unadmitted.

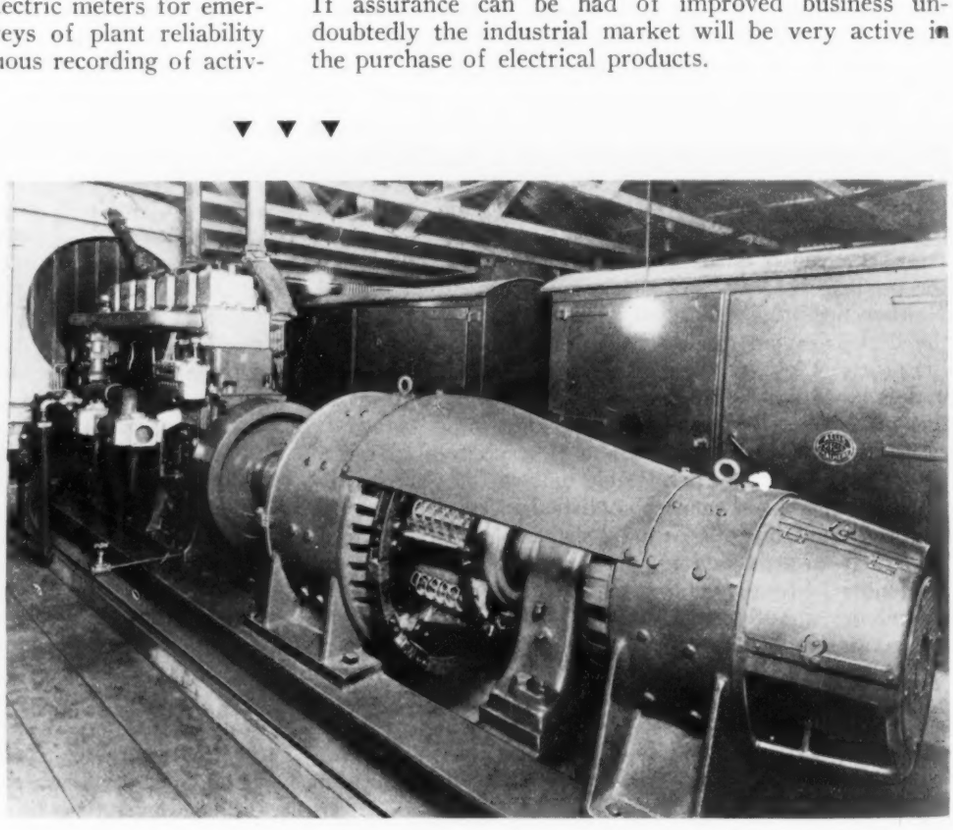
Wiring Equipment—The general trend is toward inclosed equipment. Controls and switches have been improved with explosion-proof and moisture-proof types available. Industrial plants are making more use of metal-armored cable of the parkway type for runs between buildings and in some cases even for under-floor inside distribution. This walled non-corrosive conduit is a new product available.

Power-Factor Correction—This is an issue in some lightly loaded plants because of rate penalties, but sales are curtailed by lack of appropriations for improvements. Synchronous and static condensers have moved slowly into industrial systems in spite of the fact that low plant loading often accentuates the losses from low power factor. Many plants will have to begin worrying about power factor, however, as their production rises and taxes the capacities of individual motors, lines, etc.

Marine Developments—The marine market for electrical equipment has been quite active during the year. The chief development has been to use higher pressure turbines, to reduce the space occupied and improve the efficiency of electrical equipment and the design of alternating-current motors to meet marine requirements.

Reconditioning and Rehabilitation—Many industrial plants have reconditioned their electrical equipment, especially transformers, oil breakers and switches. This can be done at relatively low cost. Other plants have redesigned their production process for more economical operation and this has involved new electrical equipment. If assurance can be had of improved business undoubtedly the industrial market will be very active in the purchase of electrical products.

▼ ▼ ▼



In drilling an oil well the classic procedure is first to find a place to put the hole, then to set up boilers and a steam engine and then to pile up coal or wood or barrels of oil for fuel. When a new field opened up the whole landscape would be cluttered with locomotive type boilers, steam engines and fuel supplies, some of them working, others being dragged to location, and not a few bogged down in mudholes, in which some even found a last resting place. But now all that can be changed if the drillers avail themselves of electricity's latest contribution to their art. Here is a direct current unit with a Waukesha engine driving an Allis-Chalmers generator set especially designed for oil well drilling. In the background are the steel cabinets housing control equipment. The outfit is completely portable and much more easily so than the steam equipment it is designed to replace.

THE WEEK

T.V.A. Analyzes the Appliance Load

FURTHER indications of the plans of the Tennessee Valley Authority in connection with the new appliance-placing Electric Home & Farm Authority, Inc., have been revealed by David Lilienthal, of both organizations.

Mr. Lilienthal said there were approximately 550,000 connected electric customers in the seven states comprising the Tennessee Valley area. He estimated that in 1934 there would be a market in that area for 100,000 electric refrigerators, 60,000 electric ranges and 25,000 electric water heaters. The sale of $10,000,000 of electric appliances, Mr. Lilienthal estimated, would mean $20,000,000 of additional business activity.

New plan to become national?

The Home & Farm Authority is set up, Mr. Lilienthal said, so it can be extended all over the United States if proper conditions arise. It is also set up, he said, in such a way that private capital can be thrown in with public credit.

The Tennessee Valley Authority so far has spent about $5,000,000 of the original $50,000,000 allotment from Congress, Mr. Lilienthal said, but declined to comment as to whether the Authority would ask Congress for additional funds next year.

T.V.A. merchandising plan

Developments are rapid for the launching of the T.V.A. program for the greater use of electricity in the homes of the Tennessee Valley. Reports indicate that the T.V.A. and the Electric Home and Farm Authority will do two or three things directly. The first is to spend money on the creation of consumer demand for electrical products and services. This means direct mail and newspaper advertising, demonstrations and all other devices available to create demand rapidly. The second step is to finance sales of refrigerators, ranges and water heaters under a tentative plan whereby the utilities make collections from consumers at cost, dealer paper is financed by the Home and Farm Corporation at low rates through the use of trust certificates acceptable to R.F.C. and possibly to private banks. On a basis of four-year term these collection and financing aids should save about 7 per cent over present methods.

Appliances of all manufacturers will be sold and distributed through regular channels. Since the T.V.A. is after the lower market strata it is proposed to have T.V.A. models of ranges, refrigerators and water heaters made available whereby manufacturers sell at low but regular prices and distributors and retailers concede part of their customary margins because sales promotion money is spent by T.V.A. The plan is restricted to the seven states in the Tennessee Valley and is open to all utilities and all appliance manufacturers. Utilities may possibly be forced to obligate themselves to T.V.A. rates for these appliances, or at least to competitive inducement rates, before they are licensed to sell under the plan.

It is presumed that any appliance manufacturer can submit a proposed T.V.A. model appliance for approval to be sold under the plan, and of course other types and prices of these appliances may be sold. Utilities will collect upon a cost-of-operation basis for all retailers selling the T.V.A. models. Competition, of course, will involve the sale of products of the several manufacturers to the homes.

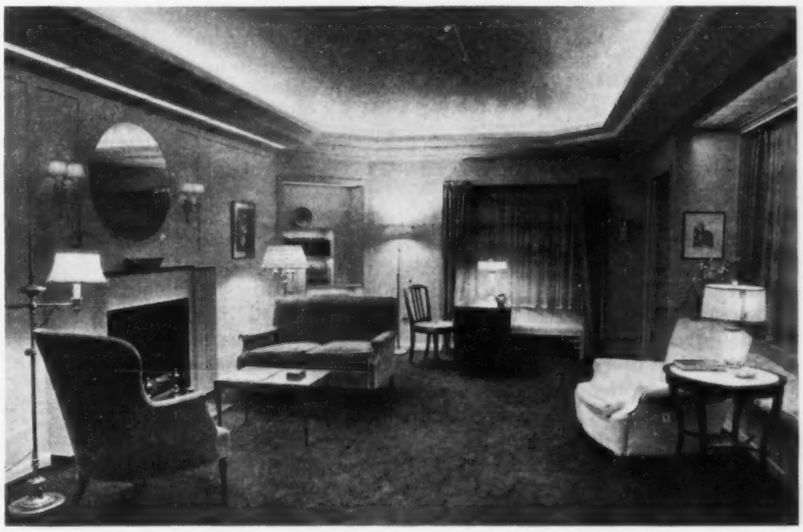
In other words, the T.V.A. is trying to build up load quickly and economically by use of government money to create consumer demand and to finance sales. It hopes to make this a self-liquidating investment over a period of years. Several private utilities and electrical manufacturers are reported to have agreed to the main plan and to plan to go along. No details are yet available as to the definite merchandising margins and costs or as to the handling of wiring and installation costs. Details are being worked out rapidly and the program is to be launched in the near future.

Mississippi plan blocked

Mayors of municipally owned electric power plants, whose cities admittedly derive profitable revenue from the sale of electric energy, last week blocked a movement before the Mississippi Municipal Officers' Association for massed application by 250 cities of that state for Tennessee Valley Authority electric power.

So well had these city officials organized in holding off massed approval of

A Living Room of Today



General Electric has just opened a new institute in Cleveland to demonstrate the best in today's lighting and various electrical services for the home, garden and store. Here are the illuminating engineer's suggestions for today's ideal living room. Wholly familiar floor and table lamps and side bracket services vie with more modern panel and cove lighting. The ultimate fate of the suggestions remains, as before, in the hands of the householder, who may or may not accept the new or reject the old.

T.V.A. power, no effort was made at the Jackson, Miss., conference to bring forth a previously suggested resolution urging some 250 municipalities to make application for T.V.A. power, the resolution calling on the state's congressional delegation to support T.V.A. was withheld, and even Guy W. Thaxton, division electrical engineer of T.V.A., who had come to Jackson in response to an invitation to appear before the association and outline the policies of T.V.A., was not called upon to speak.

Clinton votes T.V.A. power

By nearly an eight-to-one vote, Clinton, Tenn., has gone on record as favoring the purchase of Muscle Shoals power from the Tennessee Valley Authority. This town, about 7 miles from the new Norris Dam on Clinch River, voted 185 to 25 for installing an electric power and light distribution system served by the T.V.A.

Organization of farmers of six northeast Mississippi counties into rural electric power associations, to buy current at wholesale from the Tennessee Valley Authority, will be conducted by the agricultural extension service of Mississippi State College, it has been announced.

Not content with worlds already conquered, Senator Norris, father of Muscle Shoals and patron saint of the T.V.A. plans new conquests. In cooperation with Representative Burke of Nebraska a double attack in both Senate and House will be launched for a Missouri Valley development to take precedence over Columbia River and St. Lawrence projects on the theory that it would hasten the rehabilitation of the farmer and his purchasing power.

▼

Georgia Supreme Court Backs Ousting of Utility Board

In two unanimous decisions the Georgia Supreme Court has backed Governor Eugene Talmadge in his dismissal of the state public service commission (ELECTRICAL WORLD, July 29, 1933, page 130), holding that the executive had such authority and that his action was not subject to review by the courts. The court backed up the governor's view that the commissioners are under suspension until the next general assembly when both houses must review the suspension. If both houses approve his action the commissioners are automatically expulsed.

"The office of public service commissioner is a statutory office and the power of the legislature is absolute with respect to all offices that it creates where no constitutional restriction is placed upon its power with reference to such office." held the court. "The fact that the petitioner may conceive that his character and reputation are assaulted does not render the statute unconstitutional."

In connection with the contention of the suspended commissioners that they had not received an adequate hearing, the court ruled that the governor's power of suspension is not limited to certain causes, decreeing that "he may suspend a commissioner for any cause satisfactory to himself."

1934 Brings Justified Hope

Not for three years have there been such widespread expressions of confidence for the future of business by economists, executives and lay brothers as greet the passing of 1933. Hope and evidences of recovery mingle. Much of the year-end hopefulness may have been linked with the improvement in Christmas trade, up 23 per cent from 1932. Later figures were less encouraging. For the week ended December 23 carloadings were off 5 per cent and bituminous coal production somewhat less. Steel output down slightly. Energy generation well sustained. Latest employment figures are less encouraging.

All in all, the prospects for 1934 are definitely brighter. Trade volumes are in general gaining and prices are responding more naturally than heretofore. The disappointment registered by security markets in the President's colorless message to Congress was not unanticipated. Those who look for a rapid recovery are quite likely to be disillusioned by the slowness of either natural or forced improvement.

▼

Governor Lehman Backs New York Reforms Again

Addressing the New York State Legislature, this week in his annual message, Governor Lehman urged that St. Lawrence "power be developed as quickly as possible for the benefit of the consumers of electricity in this state" commended the new uniform system of accounts, recently instituted, and suggested nine specific legislative enactments.

The measures backed include permitting any municipality to construct or acquire a public utility plant and sell its service, including formation of public utility districts; clarifying powers of commission to order temporary decreases in rates; authorizing assessments against utilities of portions of commission expenses; limitation of holding company charges against operating companies to actual cost of service rendered; prohibition of payment of fees to holding companies without commission approval, and preventing of allocating holding company financing charges to operating expenses.

▼

Lamps Bring Code Protest

Charges that a few limited licenses monopolize the manufacture and sale of incandescent electric lamps so that the independent makers of sources are unable to secure redress from NRA or the Electrical Code Authority went to General Johnson before the electrical manufacturing code rehearing this week. Donald R. Richberg, general counsel for NRA, "frankly admitted" that the criticism was "well justified."

N.E.M.A. Likes Code Results; New Plans Discussed

Reporting a "definite and desirable stabilization" of the electrical manufacturing industry as a result of 4½ months' operation under its NRA code of fair competition, the National Electrical Manufacturers Association has indicated some tangible benefits.

Data on labor provisions were collected by the association from 871 plants employing more than 179,000 wage earners. Analysis showed 60 per cent of the plants to be paying their lower rated employees at rates higher than in 1929; 47 per cent are now paying male employees at a minimum rate of 40c. an hour or more; of the plants that employ women, 38 per cent are paying at minimum rates of 40 cents or more.

Practically all the plants have raised hourly wage rates for lower grades of work compared with their rates of May, 1933. Actually, 36,519 wage earners who were formerly being paid at less than 40 cents an hour are now being paid at 40 cents an hour or more.

NRA cost control plan

A practical plan for the control of manufacturing costs, upon which uniform accounting systems of trade associations will be based, has been adopted in part by the National Recovery Administration.

The plan, devised by W. Clement Moore of the Philadelphia Board of Trade, and John K. Hulse, certified public accountant, divides industries into two sections: the first, covering estimating or servicing industries, in which goods are manufactured upon specifications; the second, industries producing more or less standardized units for resale, to which standard costs per unit may be applied.

Instead of using average costs, which the authors called indefinite and impracticable, they are emphasizing frequency costs and rates, based on normal operations and, wherever possible, brought down to terms of composite

hour rates and usually efficient production as a standard.

For the servicing or estimating groups, a uniform chart of accounts, a uniform estimating manual and a uniform cost-accounting system are being provided.

The cost-accounting system enables manufacturers to check actual costs in their own plants against an estimating manual.

▼

American Commonwealths Power

The protective committee for holders of the first preferred stock of the American Commonwealths Power Corporation has written to holders of certificates of deposit of the preferred stock that "after almost two years of arduous labor on the part of the committee, without compensation, it is evident that no recovery whatsoever can be effected for the stockholders."

▼

Utility Dividend Changes

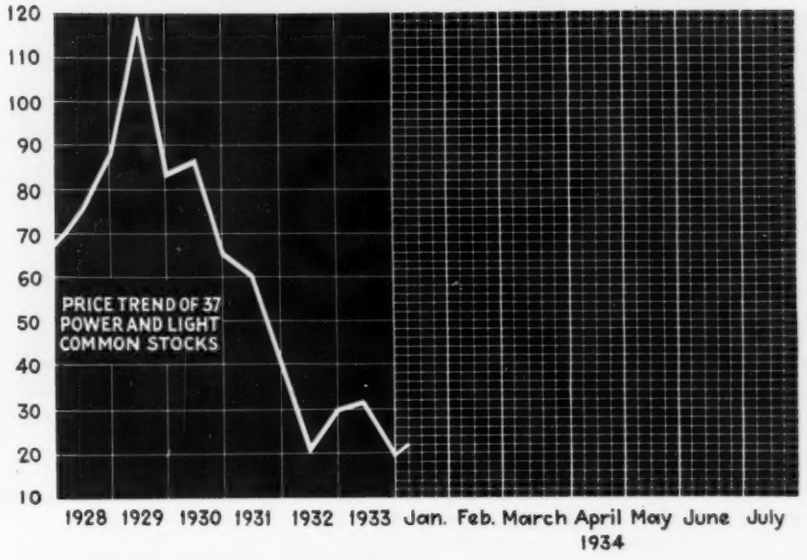
Philadelphia Company last week declared a quarterly dividend of 17½ cents a share on the common, compared with 12½ cents a share three months ago and 25 cents six months ago. Directors of the Public Service Company of Indiana have voted not to pay the dividend on prior preferred stock for the last quarter of 1933. C. D. Porter, vice-president and general manager, advised the board that increased taxes, increased operating costs due to the NRA and rate reductions, which have cost the company more than $550,000 annually, have reduced the company's net earnings so that it is impossible to pay even one-half of the usual dividend.

▼

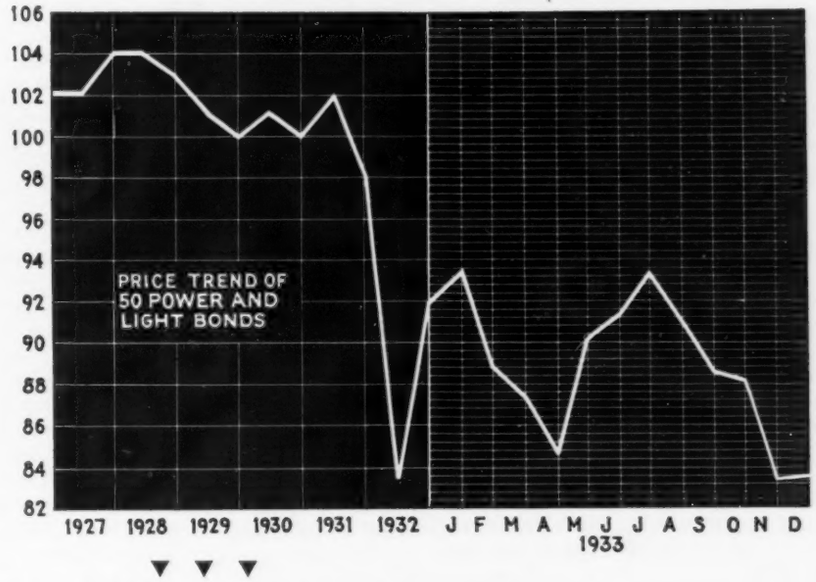
Central States Reorganization

Consideration of proposed reorganization plans for Central States Edison Company, now in receivership, has been deferred until January 26 by Chancellor J. O. Wolcott of Wilmington, Del.

Utility Stocks and Bonds Stronger



Rising sharply from the year's low, 19.6, in the previous week the "Electrical World" average for utility common stock prices started the new year at 21.1. Bonds, which had been declining since last July, held the level of the previous month, 83.3, as the year ended.



▼ ▼ ▼

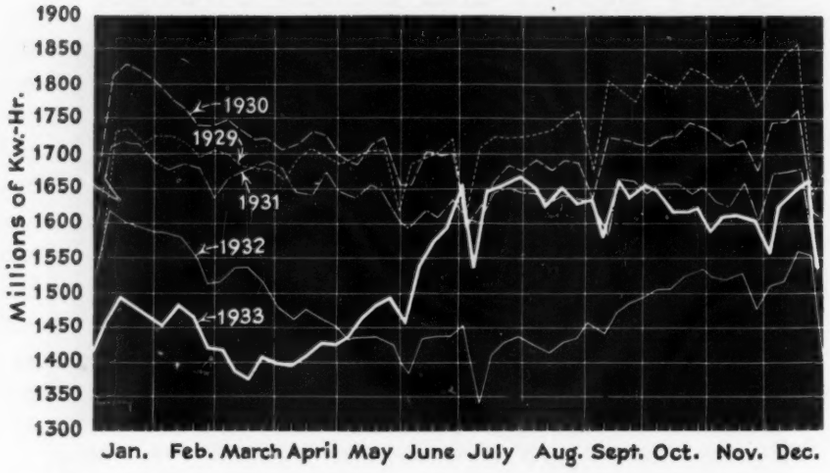
Current Earnings Reports of Electric Light and Power Companies

	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
Operating Companies					
Detroit Edison (Year ended November 30)					
Gross earnings	$41,463,007	$44,469,028	— 6.8	68	70
Net earnings	13,013,625	13,061,425	— 0.3	..	..
Net balance	6,460,899	6,933,806	— 6.8	..	..
Holding Companies					
American Gas & Electric and subsidiaries (Year ended October 31)					
Gross earnings	$63,231,965	$66,340,927	— 4.7	61	57
Net balance	7,693,232	10,577,297	— 27.4	..	..
American Power & Light and subsidiaries (Year ended October 31)					
Gross earnings	73,111,313	77,249,769	— 5.3	56	52
Net balance*	5,024,664	10,094,347	— 5.1		
Electric Power & Light and subsidiaries (Year ended October 31)					
Gross earnings	68,615,788	74,467,784	— 7.9	64	58
Net balance	776,900†	5,663,292*	—113.7	..	..
National Power & Light and subsidiaries (Year ended October 31)					
Gross earnings	68,725,961	72,506,060	— 5.2	60	60
Net balance*	7,144,945	8,899,019	— 19.8	..	..
Public Service Corporation of N. J. and subsidiaries (Year ended November 30)					
Gross earnings	117,050,094	127,668,875	— 8.3	64	66
Net balance*	26,729,239	29,140,413	— 8.3	..	..
United Light & Power and subsidiaries (Year ended October 31)					
Gross earnings	73,132,274	80,475,057	— 9.1	69	68
Net balance	1,687,288†	1,749,951	—197.0	..	..

* Before all dividends. † Deficit.

Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings—Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Net balance—Balance available from income for common stock dividends.

Energy Output in Christmas Week



Christmas week brought a smaller decline in central-station energy output than in 1929, 1930 or 1932. The production of 1,539,002,000 kw.-hr., as announced by the Edison Electric Institute, increased the lead over 1932 to 8.8 per cent, the largest since the first week in October. It approached within 1.7 per cent of the output during the week including Christmas in 1931.

The margin of gain over 1932 was larger than for the preceding week in every geographical division except the South. Most of the percentages were the highest since early autumn. Advances were greatest on the Coast—rising from 2.7 per cent over 1932 to 8.6 per cent—and in the Central industrial area—from 9.6 to 14.3 per cent.

Per Cent Change from Previous Year

Region	Week ended Dec. 30	Dec. 23	Dec. 16
New England	+ 8.7	+ 6.7	+ 7.1
Middle Atlantic	+ 6.2	+ 6.1	+ 4.1
Central Industrial	+14.3	+ 9.6	+ 8.2
West Central	+ 4.3	+ 3.1	+ 2.4
Southern States	— 3.7	+ 1.5	— 0.9
Rocky Mountain	+19.5	+16.0	+14.6
Pacific Coast	+ 8.6	+ 2.7	+ 1.0
United States	+ 8.8	+ 6.6	+ 5.2

Weekly Output, Millions of Kw.-Hr.

1933		1932		1931	
Dec. 30	1,539	Dec. 31	1,415	*Jan. 2	1,524
Dec. 23	1,657	Dec. 24	1,554	Dec. 26	1,565
Dec. 16	1,644	Dec. 17	1,563	Dec. 19	1,676
Dec. 9	1,619	Dec. 10	1,519	Dec. 12	1,672
Dec. 2	1,554	Dec. 3	1,510	Dec. 5	1,671

*1932.

▼

All Fast Meters Barred by New York Regulation

Preceded by the gathering of testimony, much of which was ruled out as evidence, the New York Public Service Commission has ordered made effective at once its much-discussed meter rule (ELECTRICAL WORLD, January 28, page 114) barring fast tolerances in the testing of watt-hour meters. Under the previously existing rules, effective since 1921, a tolerance of 1 per cent fast or slow was permissible. The new regulations require all watt-hour meters to register accurately or between 100 per cent of accuracy and 2 per cent slow, at light and full loads, which means that all electric meters now placed in service must be accurate or they may be slow by 2 per cent.

Chairman Milo R. Maltbie recommended the adoption of the new regulations in an opinion which the commission approved. His opinion discusses the present rule which permits companies to put into service meters that are 1 per cent fast or meters that are 1 per cent slow and states that "there is every inducement for company employees not to put meters in service that are slow, and, as the commission does not verify the tests made by the companies, there is no guaranty that company employees do not yield to the inevitable temptation to err on the side favorable to the companies, viz., to pass meters that are fast, while readjusting those meters that are slow."

"Under such conditions," says Chairman Maltbie, "it is asking too much of human nature to expect an equal division of fast and slow meters. Under such conditions companies should not be allowed to put meters in use that are fast. The proposed rule prevents this and offers every inducement to adjust meters as close to absolute accuracy as possible, to allow only the narrowest limits of tolerance consistent with good business economy."

Regarding the contention that the new rules would cause a loss in revenue or an increase in expense of meter testing, Chairman Maltbie has stated: "It is clear that if the companies permitted the full tolerance allowed under the proposed rules there would be no increase in expense, since the over-all tolerance in both cases is 2 per cent."

Chairman Maltbie also calls attention to the fact that four large companies in New York City voluntarily adopted a much more rigid standard than the new rules require and found it entirely practicable. He also points out that in meter tests for gas companies the commission provided for a tolerance similar to that now proposed for electric companies, and this rule for gas companies has been in effect 25 years.

▼

Traveling Cooking School Attended by 112,000

Touring the country in 1933 as in 1932, a jointly sponsored educational and sales effort of the Westinghouse Electric & Manufacturing Company and of the Kroger Food Foundation has been drawing phenomenal crowds.

Attendance records show more than 112,000 women to have attended the first 36 classes held this year, while more than 7,000 would-be participants were turned away from crowded halls. Attendance at the 1933 sessions is more than 50 per cent greater than last year, when the total attendance for 96 classes reached 215,000. During the first twelve weeks of the school's 1933 tour Kansas City, Mo., set a record for attendance with more than 19,000 women present for the three classes.

An indirect sales approach such as this must be judged for effectiveness in the reflection of interest through increased merchandise sales. In the period of five weeks following the closing of the show in the six cities already checked traceable results indicate 98 refrigerators to have been sold by local Westinghouse dealers. In addition more than 50 Westinghouse ranges and a large company of mixers, coffee makers, toasters, automatic irons and other electrical appliances were sold.

The school is conducted in each city for three days. For two weeks prior to the opening of the school publicity is given to the coming activity in Kroger and Westinghouse dealer advertising and in the news columns of the local papers. So keen is the interest manifested in the school that even the largest halls have failed to hold the crowds.

Immediately after Thanksgiving the school, with its complete Westinghouse electric kitchen equipment and staff of nine people, continued its scheduled tour of 23 weeks.

▼

British Rail Extension

Southern Railway of England, already operating the largest suburban electrified system in the world, has decided to extend its electrified lines to Sevenoaks, Kent, an addition of 23 route miles. The cost is estimated at roughly $2,500,000. The third-rail, direct-current system, as elsewhere in the company's electrified area, will be used. Eleven important suburban stations are affected by the change.

New York Metal Prices

	Dec. 26, 1933 Cents per Pound	Jan. 2, 1934 Cents per Pound
Copper, electrolytic	8.25	8.25
Lead, Am. S. & R. price	4.15	4.00
Antimony	7.12½	7.25
Nickel ingot	35.00	35.00
Zinc, spot	4.80	4.70
Tin, Straits	53.00	53.00
Aluminum, 99 per cent.	23.30	23.30

Municipal Items

MITCHELL, NEB.—A condemnation court made up of three district judges has fixed the value of the property of the Western Public Service Company in this city at $39,886. This is $5,000 greater than the valuation fixed by engineers for the city, which has voted to acquire the plant, and $27,000 less than that claimed by the company. Under the law the company has the right of appeal, but the city may take possession upon issuance and sale of bonds within the next 90 days.

OBERLIN, OHIO.—Federal Judge Samuel H. West has denied an injunction sought by the Ohio Electric Power Company to prevent this city from selling bonds voted last year for the building of a municipal light plant. An injunction was granted prohibiting the city from breaking its contract with the company for supplying street lighting current and power for the city's pumping plant. Judge West ruled that the city could sell the bonds, construct the plant and operate it to serve residents of the city.

WARREN, OHIO.—Sworn statements to withdraw signatures from petitions for referendum on a recently enacted light rate contract were filed last week by the local chamber of commerce and allied organizations. It was announced that enough people had withdrawn signatures to kill the referendum plea. The light rate ordinance was passed November 18 to wipe out an old street light bill, pay for a new system and pay lighting costs by raising the rates on domestic and commercial consumers.

HILLSBORO, TEX.—This city has been enjoined from installing its own light and power plant. The injunction was granted by Judge Ball on the petition of S. L. Robertson and others. Defendants named in the petition were C. W. Maier, Mayor; Fairbanks-Morse Company, whose bid the city recently accepted for engines and equipment for the installation of a municipal plant, and others.

CULPEPER, VA.—Application of the Virginia Public Service Company for an injunction to restrain this town from issuing bonds for the erection of a municipal light and power plant (ELECTRICAL WORLD, December 30, page 843) has been refused by Judge A. T. Browning in Circuit Court. The company charged in its application that the grounds on which the town was issuing these bonds, by act of the recent special session of the General Assembly, was unconstitutional, inasmuch as the bill was drawn up as a general act and adopted under special act provisions. The case has attracted wide interest as a large number of similar projects are pending in Virginia. An appeal to the Virginia State Supreme Court of Appeals is planned by counsel for the company.

EDNA, TEX.—Loan of $150,960 requested from the Public Works Administration for the construction of a light and ice plant is being opposed by representatives of the Central Power Company, which serves the city. The state board has heard arguments of both sides, but no decision was announced.

PLAINVIEW, TEX.—Objections have been made by the Texas Utilities Company to a loan of $423,466 which the city has requested from the Public Works Administration for the construction of an electric light plant. The state board has heard arguments of both sides, but no decision was announced.

▼

Washing Machine Sales Set Second Best Record

Only exceeded by the boom year of 1929, nation-wide buying of household washing machines will total more than 950,000, according to J. R. Bohnen of the American Washing Machine Manufacturers Association. In 1929 the total was 1,083,000.

Total figures for 1933 on the basis of eleven months indicate that the total may be as much as 970,000. Thus production, more than 55 per cent greater than in 1932, was not for future needs, but for immediate installation in homes. According to Secretary Bohnen payments to farmers for cutting down output of cotton, wheat, corn and hogs have resulted in the cashing of government checks almost nationally. They are paying their bills and buying some of the equipment needed.

▼

Richmond Utility Sells Steam

Virginia Electric & Power Company has joined the ranks of those electric utilities selling process steam to industrial plants and has completed the installation of a steam service to the Brown's Island mill of the Albemarle Paper Manufacturing Company of Richmond. The paper company, one of the utility's largest customers, requires large quantities of steam for the drying of paper in manufacture. Under present operating conditions the paper mill uses about 25,000,000 lb. of steam each month, with an average hourly flow of 40,000 lb. Service may be expanded.

Major New Construction This Week

Atlantic City Electric Company plans transmission line to Hammonton, N. J., and vicinity.

Independence, Mo., seeks $228,800 for installation of 3000-kw. turbo-generator unit and other improvements in city-owned plant.

Roselle, N. J., plans $1,200,000 improvements, including city-owned electric light and power plant and waterworks station.

Geysers Development Company plans transmission line from Geysers to Healdsburg, Calif.

Motors, controls, transformers, conveyors, hoists, etc., will be installed by Department of Sanitation, New York, N. Y., Federal fund of $4,000,000 being secured.

Hamilton, Mont., plans $250,000 city-owned light and power plant.

New York Power & Light Corporation will build transmission line from Albany to Carmel, N. Y., and vicinity. Permission has been secured.

Coeur d'Alene, Idaho, plans city-owned plant to cost $600,000 with waterworks.

Euclid Brewing Company, Cleveland, Ohio, plans $350,000 expansion.

Corinth, Miss., plans $110,000 electric distribution system.

▼

Lamp Sales of 1933

Preliminary estimates of the incandescent lamps sold in the United States in 1933 indicate 616,000,000 large and small units to have been merchandised. This figure is 11 per cent above the sales in 1932, and is within 3 per cent of the sales in 1929, the only other year in which a 600,000,000 unit total has been exceeded.

▼

1,250,000 Refrigerators?

If electric refrigerator sales kept the pace set for the first ten months of this year there will be a record of 1,250,000 household units sold in 1933. According to Chairman Davidson of the Refrigeration Bureau sales through October totaled 1,010,245. Thus the bureau's long-coveted goal of a million sales in a single year was liberally realized two months before the year's end.

▼

Baltimore Street Lights

Plans to place back in service some of the street lights eliminated in 1933 are being formulated in Baltimore, Md. During last year the city saved $110,000 by curtailed lighting. The 1934 appropriation has been increased by $25,000.

As to Rates——

• Public Service Electric & Gas Company's acquisition of property near the Public Service Terminal Building in Newark, including deals involving property formerly owned by Thomas N. McCarter, president of Public Service Corporation and its operating subsidiaries, were explained at the hearing recently held before the Public Utility Commission. The hearing will continue January 11.

• Utah Power & Light Company's present rates will be subject to a general investigation by the Public Utilities Commission as forecast by E. E. Corfman, president of the commission, several weeks ago, when the complaint of the United States Army asking a 10 per cent reduction in charges made against it was being heard (ELECTRICAL WORLD, December 2, page 714). Mr. Corfman maintained that enough had been presented at that hearing to require full and complete investigation of the basis the company is using in fixing its rates. George M. Gadsby, general manager of the company, has announced that since the financial welfare of the company as a public utility must depend on public confidence, the company would welcome the investigation and would co-operate in bringing about a full presentation of the facts.

• West Tennessee Power & Light Company's rate reductions (ELECTRICAL WORLD, December 16, page 778) will be put into effect February 1 according to a statement by Porter Dunlap, member of the State Railroad and Public Utilities Commission. Details of the new schedule for 21 cities are being worked out so as to permit an annual $50,000 saving to customers in the Jackson territory.

• Savannah Electric & Power Company has announced reductions in rates for residential users of electric current, amounting to between $65,000 and $80,000 a year. The largest saving is the elimination of the $1 service charge, as foreseen (ELECTRICAL WORLD, December 30, page 842).

• Northern Indiana Power Company has filed petitions with the Indiana Public Service Commission proposing electric rate reductions in Roachdale, Waveland, Romona, Royal Center, North Salem, Shirkieville, Johnestown, Libertyville and Centenary.

• Indiana Public Service Commission has fixed a maximum rate of penalties which utilities may charge for delinquent bills. A collection charge, or penalty, of 10 per cent will be permitted for bills of $3 or less a month and the maximum for more than $3 a month will be 3 per cent. The order established the general rule that all utilities are permitted to make discount concessions to consumers for prompt payment of bills, a practice which many of them now have and which is not affected by the latest ruling. Companies now granting discounts cannot change to make the collection charge without making the matter a formal rate increase case before the commission. The order also said that no new rates containing a gross and net rate will be approved by the commission. Utilities are given until February 1, 1934, to file new rate schedules complying with provisions of the order.

• Quebec Power Company and the city of Quebec have agreed upon a new contract to supersede the present contract expiring in 1935 following three years of negotiations over rates. An agreement providing for reductions totaling $450,000 until the expiration of the present contract in 1935 and $250,000 a year during a new ten-year contract has been signed by the city and company.

Brief History of the "Electrical World"

The *Electrical World* (published under that name since 1883 and tracing its history back to 1874) is a consolidation of the *Electrical Engineer* (founded in 1882 as the *Electrician*) and the *American Electrician* (founded in 1896). Final consolidation under the title of *Electrical World* took effect on January 1, 1906, the *Electrical World* and the *Electrical Engineer* having been acquired by the McGraw Publishing Company in 1899 and amalgamated as the *Electrical World and Engineer*, and the *American Electrician*, a McGraw monthly, having been absorbed seven years later.

The roster of past editors of the *Electrical World* includes Carl Hering, Louis Bell, W. D. Weaver, T. C. Martin, C. O. Mailloux, D. H. Braymer and many other men prominent in the electrical industry—some, like those named, no longer living, and others, like W. H. Onken, Jr., A. S. McAllister, Frank F. Fowle, F. M. Feiker, and H. V. Bozell, still active in engineering and industrial service. L. W. W. Morrow is now editor. Allen M. Perry is managing editor. Other members of the present staff are: A. E. Knowlton, associate editor; E. R. Searles, news editor; G. F. Wittig, statistical editor; F. R. Innes, Western editor; C. W. Leihy, Pacific Coast editor; E. M. Glennon, assistant editor; H. S. Knowlton and Earl Whitehorne, contributing editors; and Paul Wooton, Washington correspondent.

• Washington State Department of Public Works has succeeded in having bench warrants issued against H. F. and H. H. Hessell, owners of the Connell Light & Power Company, who closed their plant rather than cut rates. Judge John M. Wilson of the Thurston County Superior Court issued warrants for their arrest on contempt of court charges. The department had ordered the company to reduce its rates 20 per cent.

• Central Hudson Gas & Electric Company's revision of the electric rate schedule which will prevent an increase in the minimum monthly charge on rural extensions due to a decrease in the number of customers per mile has been approved by the New York Public Service Commission. The revision of the rural extension plan is a modification of the "rule for fixing the number of customers per mile of line" on which the minimum monthly charge is based, providing for the recalculation only when the number of such customers increases with a resultant decrease in the minimum charge, and that such recalculation shall be made whenever the number of customers increases.

• Virginia Electric & Power Company, under an agreement negotiated last week with the State Corporation Commission of Virginia, will, effective January 15, reduce rates for electric service by an aggregate $366,300 a year. The rate cut is allegedly based on valuations established by Allen J. Saville, consultant for the commission, and was designed to reduce the utility's net return from approximately 9 to 7 per cent. The rate base cost established was, roughly, $45,000,000. All classes of consumers will benefit. About $200,000 of the estimated yearly reduction will accrue to residential consumers.

▼

Ousted Trade Commissioner Seeks Court Test of Rights

With the filing of a petition in the Court of Claims last week William E. Humphrey, President-ousted Federal Trade Commissioner, assailed the right of the nation's Chief Executive to remove a member of that body because their minds do not "go along together."

President Roosevelt in October appointed George C. Matthews to the supposed vacancy caused by Mr. Humphrey's removal (ELECTRICAL WORLD, November 18, 1933, page 645). The government has forty days in which to file an answer presenting a case to be decided on its merits by the court, or a demurrer, denying the existence of any legal cause of action. The only appeal from the Court of Claims is to the Supreme Court, where the case probably will be sent for ultimate decision.

Men of the Industry

S. B. Tuell New President Engineers Public Service

Samuel B. Tuell, for the past four years president of the General Public Service Corporation, has been elected president of the Engineers Public Service Company, a subsidiary of Stone & Webster, Inc., to succeed C. W. Kellogg, who has been made chairman of the board. Mr. Tuell, who has been a director of Engineers Public Service Company for the past six years, was a vice-president of the company from 1926 to 1929,

when he resigned to assume the duties of president of the General Public Service Corporation. He now becomes chairman of the General Public Service Corporation and F. Higginson Cabot, a vice-president of Stone & Webster, is succeeding him as president.

Mr. Tuell's connection with the Stone & Webster interests began in 1902 at Fall River, Mass. Shortly after he moved to Terre Haute, Ind., and subsequently became the operating head of utility properties, including the Key West Electric Company and the Blackstone Valley Gas & Electric Company. For a period of six years immediately prior to coming to New York, in 1926, he was in charge of the utility properties in the Middle West which were at that time under the supervision of Stone & Webster, including the Mississippi River Power Company, Keokuk (Iowa) Electric Company, Fort Madison (Iowa) Electric Company, Paducah (Ky.) Electric Company, Houghton County Electric Light Company and the Houghton County Traction Company. He was active in the National Electric Light Association, being a past-president of the Michigan Electric Light Association and having served on the executive committee of the Great Lakes Division. Monuments to his work in Colorado are the central Lacombe plant in Denver and the Valmont plant near Boulder.

D. C. Barnes, vice-president of the Engineers Public Service Company, has resigned to become vice-president of the Stone & Webster Service Corporation. Mr. Barnes has also been identified with Stone & Webster properties in various sections of the country.

Mr. Kellogg, who is relinquishing the office of president to become chairman of the board of Engineers Public Service Corporation, has held the position of president since 1925. His connection with the Stone & Webster interests dates back to 1903 following graduation from the Massachusetts Institute of Technology.

▼

L. W. Wallace Assumes New Duties in Washington

Lawrence W. Wallace, since 1921 executive secretary of the American Engineering Council, Washington, D. C., will become associated with the W. S. Lee Engineering Corporation, consulting engineers, as vice-president in charge of the Washington office. He will assume his new duties January 15. For many years Mr. Wallace has been consultant in industrial engineering.

A native of Webberville, Tex., and a graduate of Texas Agricultural and Mechanical College, Mr. Wallace obtained some practical engineering experience with the Santa Fe Railway before joining the teaching staff of Purdue University, from which institution he had received a master's degree. He served as assistant professor from 1913 to 1917 and for the two following years as professor of railway and industrial management. Again he entered the business world in 1917 as assistant general manager of the Diamond Chain & Manufacturing Company, a position he relinquished to become director of the Red Cross Institute for the Blind in Baltimore.

Mr. Wallace has written many articles and papers on industrial engineering problems for professional societies and for the technical press.

▼

JOSEPH F. AUTENRIETH, president of the Board of Public Utility Commissioners of New Jersey, submitted his resignation last week to Governor Moore. Mr. Autenrieth, a lawyer, was first appointed by Governor Edwards in 1922 and was renamed by Governor Moore both in 1927 and last spring. His resignation as a member of the commission is effective January 15.

OBITUARY

Frank L. Dame

Frank L. Dame, president and chairman of the board of the North American Company and a leading public utility executive, died December 30 at his home in Garden City, Long Island, as the result of a stroke of apoplexy. He was 66 years of age. It was in 1920 that Mr. Dame became identified with the North American organization in the capacity of vice-president and one year later was selected for the presidency. In the spring of 1932 he was elected chairman of the board of directors, but he continued active service in a full time capacity in the same co-operation with Edwin Gruhl, his successor as president, which had marked an asso-

ciation of eleven years while Mr. Dame was president and Mr. Gruhl was vice-president and general manager. Following the death of Mr. Gruhl, last January, Mr. Dame was again elected president, retaining the office of chairman of the board.

Mr. Dame also was president of Edison Securities Corporation, the North American Utility Securities Corporation and the Western Power Corporation, chairman of the board of the Cleveland Electric Illuminating Company, the North American Edison Company and Wired Radio, Inc., and an officer of other utility corporations.

Mr. Dame was born in Boston in 1867 and after graduating with a degree in electrical engineering from Massachusetts Institute of Technology in 1889 joined the Westinghouse Electric Company in Pittsburgh. He was engaged at first in construction work and began the operation of public utilities in Vancouver, B. C., in 1890. Joining the General Electric Company, he managed public utilities companies successively in Seattle, Tacoma and Dubuque, and in 1909 he was chosen vice-president of the Electric Bond & Share Company, a position which he held until the latter part of 1912. In 1913 he became identified with the organization of Harrison Williams, subsequently serving as an

officer and director of nearly all of the companies in which Mr. Williams held a controlling interest.

The electrical industry has lost a great leader. Mr. Dame was wise in council, co-operative in action and stood for high ideals in the conduct of utilities. He had wisdom, sympathy and understanding in unusual degree and these traits, together with his modesty, endeared him to all who knew him. Under his direction great properties were built and expanded on a sane and conservative basis. He believed in decentralization, in the development of good practices, in using every possible endeavor to serve the public and yet preserve the interests of stockholders and investors. He was a leader of men and a builder of men and nothing pleased him more than to see young men grow and expand into positions of responsibility. Frank L. Dame as a pioneer, as an executive and as a friend earned a deservedly high place in industry ranks.

▼

EVERETT MORSE, president of the Simplex Wire & Cable Company, and for many years prominent in Boston banking, educational and life insurance circles, died at the Phillips House, Boston, December 27 at the age of 67. He was a native of Boston and was graduated from the Massachusetts Institute of Technology in 1885. He was a fellow of the American Institute of Electrical Engineers.

▼ ▼ ▼

Directory of Electrical Associations

AMERICAN ASSOCIATION OF ENGINEERS, Secretary, M. E. McIver, 8 South Michigan Ave., Chicago, Ill.

AMERICAN ENGINEERING COUNCIL. Executive secretary, L. W. Wallace, 744 Jackson Place, Washington, D. C.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, P. W. Henry, 75 West St., New York, N. Y.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. National secretary, H. H. Henline, 33 West 39th St., New York, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 260 S. Broad Street, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West 39th St., New York, N. Y.

AMERICAN STANDARDS ASSOCIATION. Secretary, P. G. Agnew, 29 West 39th St., New York, N. Y.

AMERICAN TRANSIT ASSOCIATION. General secretary, Guy C. Hecker, 292 Madison Ave., New York, N. Y.

AMERICAN WELDING SOCIETY. Secretary, M. M. Kelly, 29 West 39th St., New York, N. Y.

ARIZONA UTILITIES ASSOCIATION. Executive secretary, J. S. Arnold, Central Arizona Light & Power Co., Phoenix, Ariz.

ARKANSAS UTILITIES ASSOCIATION. Secretary-treasurer, R. E. Ritchie, Arkansas Power & Light Company, 115½ West Fourth Street, Little Rock, Ark.

ARTISTIC LIGHTING EQUIPMENT ASSOCIATION. Secretary, James Krieger, 215 Fourth Ave., New York, N. Y.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, 80th St. and East End Ave., New York, N. Y.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Managing director, John F. Kelly, Empire Bldg., Pittsburgh, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Room 1519, Daily News Bldg., 400 West Madison St., Chicago, Ill.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, B. C. Fairchild, 409 Power Bldg., Montreal.

CANADIAN ENGINEERING STANDARDS ASSOCIATION. Secretary, B. Stuart McKenzie, Room 3064, National Research Council Building, Ottawa, Ont.

EDISON ELECTRIC INSTITUTE. Vice-President and Managing Director, Bernard W. Weadock, 420 Lexington Avenue, New York.

ELECTRIC ASSOCIATION (THE) (Chicago), manager, Ralph S. Steffens, 20 North Wacker Drive, Chicago, Ill.

ELECTRIC AND RADIO ASSOCIATION OF KANSAS CITY. Secretary-manager, G. W. Weston, 805 Power & Light Building, Kansas City, Mo.

ELECTRICAL ASSOCIATION OF NEW YORK, INC. Managing Director, R. Neumuller, Grand Central Palace, New York, N. Y.

ELECTRICAL ASSOCIATION OF PHILADELPHIA. Manager, George R. Conover, 17th at Sansom, Philadelphia, Pa.

ELECTRICAL LEAGUE OF COLORADO. Manager, George Bakewell, Jr., 334 Gas & Electric Bldg., Denver, Colo.

ELECTRICAL LEAGUE OF UTAH. Executive secretary, R. E. Folland, Chamber of Commerce Bldg., Salt Lake City, Utah.

ELECTROCHEMICAL SOCIETY, INC. (THE). Secretary, Colin G. Fink, Columbia University, New York, N. Y.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Grand Central Terminal, New York, N. Y.

FLORIDA ENGINEERING SOCIETY. Secretary, W. W. Fineren, Gainesville, Fla.

ILLUMINATING ENGINEERING SOCIETY. General secretary, D. W. Atwater, 29 West 39th St., New York, N. Y.

ILLUMINATING GLASSWARE GUILD. Assistant business manager, C. H. Ferris, Stevenson Corp., 19 West 44th St., New York, N. Y.

INSTITUTE OF RADIO ENGINEERS. Secretary, Harold P. Westman, 33 West 39th St., New York, N. Y.

INTERNATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Victor H. Tousley, 612 N. Michigan Ave., Chicago, Ill. Sections: Eastern, F. N. M. Squires, 85 John St., New York, N. Y.; Western, Chas. P. Holmes, 222 West Adams Street, Chicago, Ill.; Northwestern, F. D. Weber, P. O. Box 745, Portland, Ore.; Southwestern, C. W. Mitchell, 914 Merchants' Exchange Bldg., San Francisco, Calif.; Southern, Jos. Whitner, P. O. Box 1743, Atlanta, Ga.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, W. H. Harth, City Hall, Columbia, S. C.

INTERNATIONAL COMMISSION ON ILLUMINATION. General secretary, J. S. Preston, National Physical Laboratory, Teddington, England. Secretary-treasurer of U. S. National Committee, G. H. Stickney, Nela Park, Cleveland, Ohio.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body formed of 26 national electrotechnical committees). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA PUBLIC UTILITIES ASSOCIATION. Managing Director, Joe Carmichael, 310 Crocker Bldg., Des Moines, Ia.

KENTUCKY ASSOCIATION OF PUBLIC UTILITIES. Secretary, E. F. Kelley, 1109 Kentucky Home Life Bldg., Louisville, Ky.

MARYLAND UTILITIES ASSOCIATION. Secretary, D. E. Kinnear, United Railways & Electric Co. of Baltimore, 803 Court Square Bldg., Baltimore, Md.

MICHIGAN ELECTRIC LIGHT ASSOCIATION, Secretary, Herbert Silvester, P. O. Box 18, Ann Arbor, Mich.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary N. R. Beagle, Jefferson City, Mo.

THE MISSOURI VALLEY ELECTRIC ASSOCIATION. Director, Thorne Browne, 1527 Sharp Building, Lincoln, Neb.

NATIONAL ASSOCIATION OF RAILROAD AND UTILITIES COMMISSIONERS. Secretary, James B. Walker, 270 Madison Ave., New York, N. Y.

NATIONAL COMMITTEE ON THE RELATION OF ELECTRICITY TO AGRICULTURE. Director, E. A. White, 1116 Garland Bldg., Chicago.

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION. Secretary, Laurence W. Davis, 420 Lexington Ave., New York, N. Y.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederick A. Lind, 1010 Marquette Building, Chicago, Ill. Central, New England, New York and Middle and Southern Atlantic States Division.

NATIONAL ELECTRICAL MANUFACTURERS' ASSOCIATION. Managing director, A. W. Berresford, 155 East 44th St., New York, N. Y.

NATIONAL ELECTRICAL WHOLESALERS' ASSOCIATION. Managing director, E. Donald Tolles, 165 Broadway, New York City. Pacific Coast Division: secretary, Albert H. Elliot, 903 Flatiron Bldg., San Francisco.

NATIONAL FIRE PROTECTION ASSOCIATION, Chairman of electrical committee, A. R. Small, 109 Leonard St., New York; secretary of electrical committee, V. H. Tousley, 612 N. Michigan Blvd., Chicago.

NATIONAL SAFETY COUNCIL, INC., Managing director and secretary, W. H. Cameron, Civic Opera Building, 20 North Wacker Drive, Chicago, Ill.

NEW YORK ELECTRICAL SOCIETY, INC. Secretary, A. Pettijohn, 29 West 39th St., New York, N. Y.

NORTH CENTRAL ELECTRIC ASSOCIATION Secretary-manager, J. W. Lapham, 803 Plymouth Bldg., Minneapolis, Minn.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, Berkeley Snow, 707 Spalding Building, Portland, Ore.

OKLAHOMA UTILITIES ASSOCIATION. Manager, E. F. McKay, 1020 Petroleum Building, Oklahoma City, Okla.

PACIFIC COAST ELECTRICAL ASSOCIATION Managing Director, K. I. Dazey, Room 630, 447 Sutter St., San Francisco, Calif.

PENNSYLVANIA ELECTRIC ASSOCIATION, Managing director, A. B. Millar; secretary-treasurer, Harold A. Buch, Telegraph Bldg., Harrisburg, Pa.

PUBLIC UTILITIES ASSOCIATION OF VIRGINIA. President T. Justin Moore, Virginia Electric & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, A. Bliss, McCrum, P.O. Box 1483, Charleston, W. Va.

ROCKY MOUNTAIN ELECTRICAL ASSOCIATION. Managing Director, George E. Lewis, 336 Gas and Electric Bldg., Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. Secretary-treasurer, J. Smieton, Jr., 420 Lexington Ave., New York, N. Y.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOCIETY OF INDUSTRIAL ENGINEERS. Secretary, Geo. C. Dent, 205 West Wacker Drive, Chicago, Ill.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. M. Jennings, Green Mountain Power Corp., 102 S. Winooski Ave., Burlington, Vt.

WESTERN SOCIETY OF ENGINEERS. Director and secretary, E. S. Nethercut, 205 West Wacker Drive, Chicago, Ill.

WISCONSIN ASSOCIATION OF ELECTRICAL CONTRACTOR-DEALERS. Secretary, E. H. Herzberg, 2103 N. 57th Street, Milwaukee, Wis.

WISCONSIN UTILITIES ASSOCIATION. Executive secretary, John N. Cadby, 135 W. Wells St., Milwaukee, Wis.